SEPTEMBER, 1924

Railway Engineering and Maintenance

Lowest cost per unit of Service

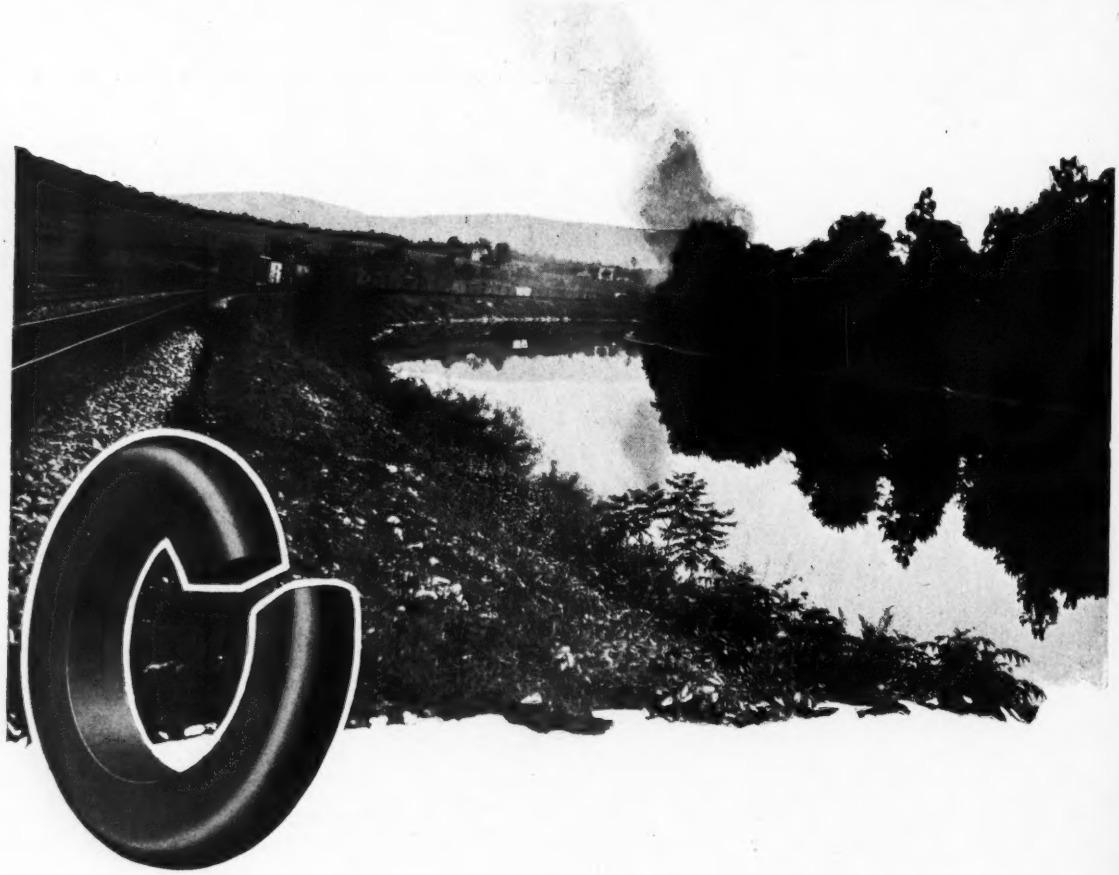
Vaughan—
Henggi—
Yardley—
Fair—

Rail Anti Creepers

CHICAGO THE P. & M. CO. NEW YORK

MONTREAL LONDON PARIS CALCUTTA SYDNEY

HY-CROME



NON-FATIGUING "spring"—a HY-CROME characteristic that keeps nuts tight and maintenance low.

THE RELIANCE MANUFACTURING COMPANY
MASSILLON, OHIO

New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco

Engineering Materials, Ltd., McGill Building
Montreal, Quebec, Canada

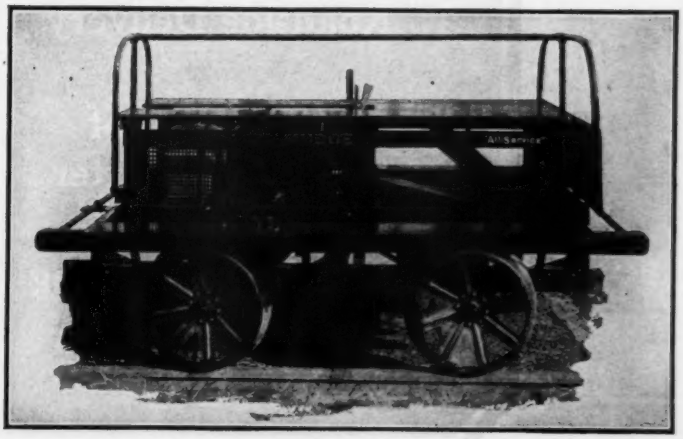
RAILWAY ENGINEERING AND MAINTENANCE
Entered as second-class matter June 23, 1916, at the post office at Chicago, Ill., under the Act of March 3, 1879. Published Monthly by Simmons-Boardman Publishing Company at 608 S. Dearborn St., Chicago. Subscription price, United States, Canada and Mexico, $2.00 a year; foreign countries, $3.00 a year.

Alphabetical Index to Advertisers, Page 36 Classified Index to Advertisers, Pages 34 and 36

One Car For All Gang Work

The Mudge "ALL-SERVICE"

THE introduction of the Mudge "ALL-SERVICE" Car has established a new precedent and a new conception of motor car utility. The possibility of using the same car for both light section gang work and heavy extra gang work has never before been conceded.



POWER
UTILITY
SIMPLICITY
ENDURANCE
} = *ECONOMY*

Custom and mechanical limitations have always dictated that section cars and extra gang cars should be of radically different design. The Mudge "ALL-SERVICE" proved that theory to be obsolete and proved that it is not only entirely practical but also decidedly economical to use the one car for all gang work. It is truly an "ALL-SERVICE" Car, powerful enough for extra gang work, light enough for section gang work, simple and rugged in its design and priced at a section car price.

Not "Just Another Car"
A New Idea in Motor Car Utility

Send for Specifications

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. • CHICAGO

Three Uses of HORTON Conical-bottom Tanks

1. Roadside Delivery
2. For Removal of Suspended Matter
3. For Water-treating Plants

Standardize *on the* Tank that Does 3 Things

In a recent report to his superiors an engineer said, "By installing the conical-bottom Horton tank at roadside stations we can provide tanks which are easily adaptable to softening tanks when we obtain authority for treating our water."

This far sighted view is one in which many engineers participate, and we commend it to the men to whose attention this adaptability of the Horton tank may not have come.

The three-fold use of the conical-bottom tank enables the engineering or water service department to standardize upon one type of tank for all purposes.

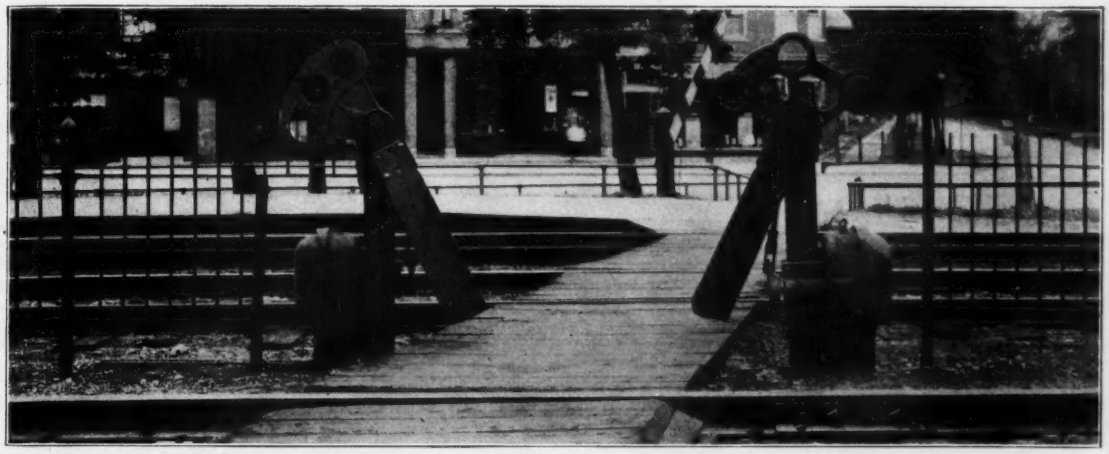
We should like to mail *you* some accounts of actual experiences with the Horton tank.

Chicago Bridge & Iron Works

CHICAGO 2452 Old Colony Bldg.
DALLAS 1646 Praetorian Bldg.
SAN FRANCISCO 1007 Rialto Bldg.
NEW YORK 3156 Hudson Terminal Bldg.
ATLANTA 1036 Healey Bldg.

337

HORTON TANKS



Two Old Semaphore Blades Make an Effective Crossing Gate.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 20 **September, 1924** **Number 9**

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EDWARD A. SIMMONS, *President*
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WOULD YOU LIKE TO KNOW

How to order ties for a bridge on a curve?

How to detect leaks in a pipe line?

What roads are canting rails?

How camp cars may be improved?

How a mile of track may be laid in 20 minutes?

Answers to these and other practical questions will be found elsewhere in this issue.

ELMER T. HOWSON, *Editor*
WALTER S. LACHER, *Managing Editor*
MILBURN MOORE, *Associate Editor*
DAVID A. STEEL, *Associate Editor*
H. F. LANE, *Associate Editor (Washington, D. C.)*

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SAN FRANCISCO: 74 New Montgomery Street

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Request for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address please be sure to send us your old address as well as the new one.

Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents. Foreign subscriptions may be paid through our London office (34, Victoria Street, S. W. 1) in £-s-d.

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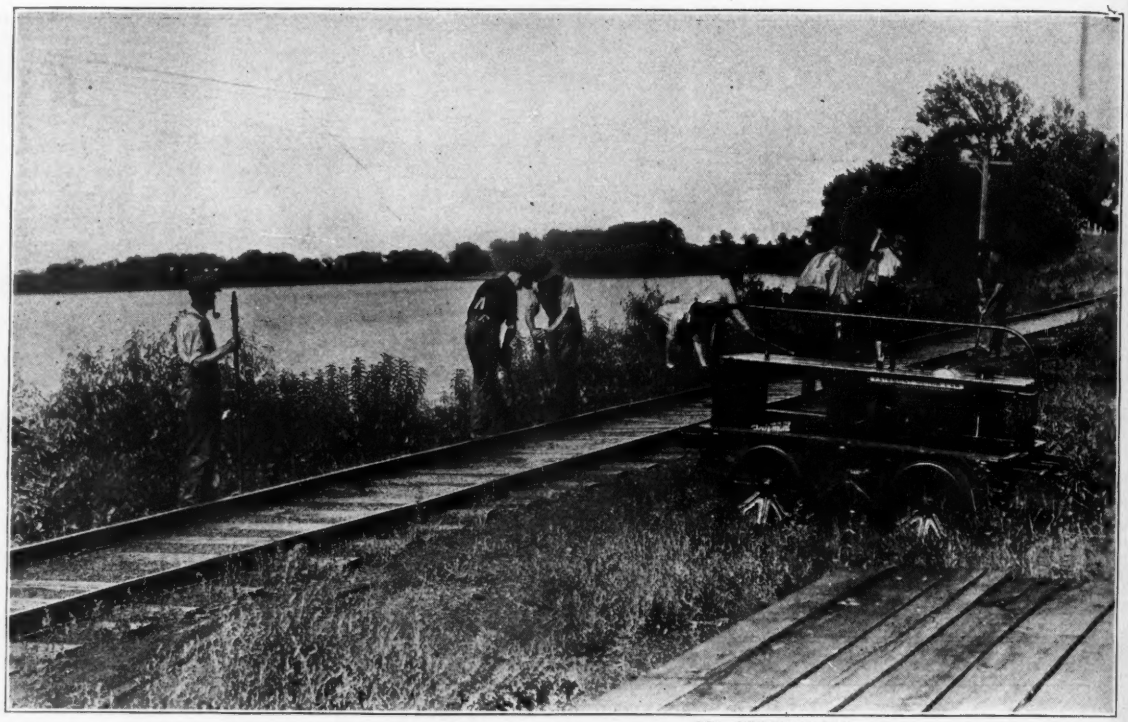


M2-SECTION CAR

Reasons for Fairmont Leadership and Economy

One-piece throttle valve (patented) with single lever engine control. Shoots a stream of fresh gas right to the spark plug when valve is nearly closed. Engine pulls well and runs smoothly at very low speed. Perfect throttle control, another reason for Fairmont economy.

Note These Figures

Time:—A month — one year after being placed in service.

Place:—Division Transcontinental Railroad

Performance:—14 Fairmont M2 gang cars won the confidence of an anti-Fairmont division and fulfilled all the requirements of section gang duty—Covered 4,780 miles during month in question averaging 25.1 miles per gallon of gasoline.

Cost per car per 100 miles:

Operation	.80
Maintenance	.15
Overhead	1.04
TOTAL	*$1.99

*(Name of Railroad furnished on request)

Performance on the Job Counts

Fairmont Gives Proof In Performance

From a technical point of view the Fairmont Motor Car is a highly advanced example of modern engineering.

From the manufacturing angle it represents the most thorough, scientific craftsmanship.

In actual performance—on all roads, under all conditions, it has demonstrated unequaled service. Whether judged by working efficiency—power, dependability, safety and comfort, or by the dollars-and-cents standard, the Fairmont leads the field.

Challenging competition alike for quality of service and low cost of running and upkeep—it is significant that the verdict of more than 700 of America's roads was for Fairmonts. Fairmonts should, logically, be your choice, the next time this type of equipment is up for consideration.

It is easy to convince the open-minded of Fairmont superiority when details of building are considered. Take, for example, the patented one-piece throttle valve which insures the economy and convenience of perfect throttle control.

This and all other details are explained in our bulletins—Write for them.

FAIRMONT RAILWAY MOTORS, INC., Fairmont, Minn.

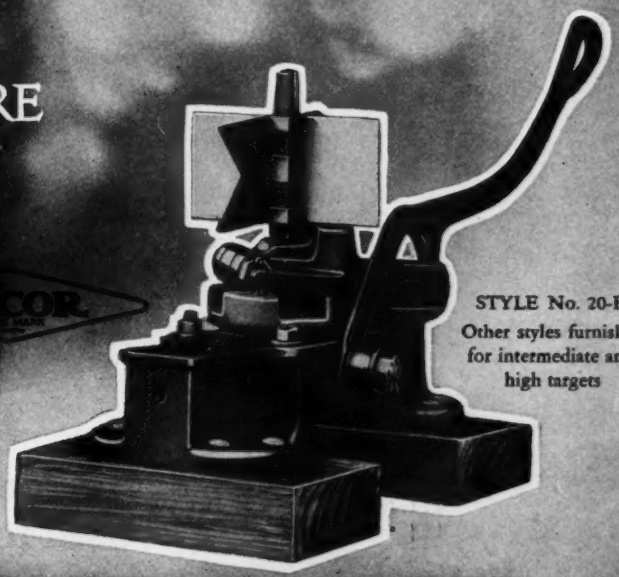
Fairmont

Ball-Bearing Engines and Railway Motor Cars

ALL STANDS IN THIS YARD ARE RAMAPO SAFETY SWITCH STANDS

RACOR

Hundreds of other terminals all over the country use Ramapo No. 20-B's exclusively.



STYLE No. 20-B.
Other styles furnished for intermediate and high targets

"SAFETY FIRST"

One of the most deb[illegible] target indicating safety. [illegible] circuit protection. The [illegible] Ramapo Safety Switch Stands.

Manufactured by

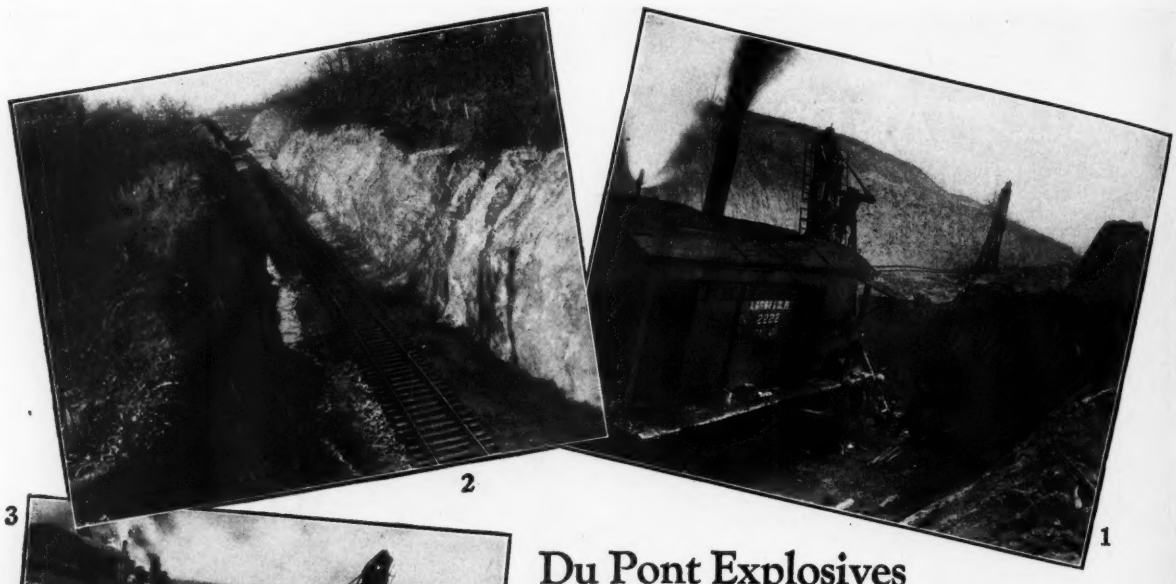
RAMAPO AJAX CORPORATION
HILLBURN, NEW YORK

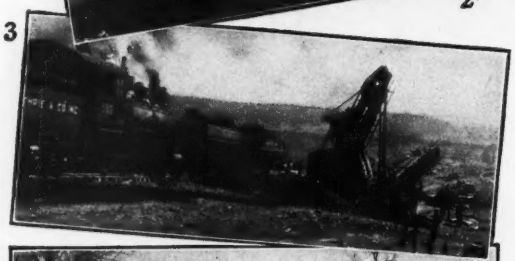
Works
Hillburn, New York Chicago, Illinois Superior, Wisconsin Niagara Falls, New York

Canadian Ramapo Iron Works, Limited, NIAGARA FALLS, ONTARIO

New York Office, 30 CHURCH STREET - *Chicago Offices,* 2503 BLUE ISLAND AVE. and McCORMICK BLDG.

Also Manufacturers of RACOR Heavy Duty Heat Treated Guard Rail Clamps; Double Shoulder Rolled Switch Plates; Manganese Reinforced Switch Points; Ajax Manganese One-Piece Guard Rails; Switches, Frogs, Crossings and General Railway Track Material





1. *One of the 17 steam shovels employed on the job.*
2. *Section of track laid at western end of new construction Illinois Central Railroad.*
3. *Part of the "standard gauge" outfit—three 60-ton locomotives and thirty 12-yard Western air-dump cars.*
4. *One section of the dump trestle extending across the Pond River bottom.*

Du Pont Explosives Used to Build New Railroad into Kentucky Coal Field

IN the construction of a second main line of the Illinois Central Railroad connecting Central City and Dawson Springs, Ky., the use of du Pont explosives, under the capable direction of the construction engineers, ensured the completion of the contract according to its specifications.

Over 2,000,000 cubic yards of sand-rock of varying degrees of hardness were blasted with du Pont gelatin—an explosive not affected by the excessive rains prevalent during a greater portion of the construction period.

An equipment of 17 steam shovels loaded the shattered sand-rock into trains of dump-cars drawn by 60-ton locomotives—a man-size job to keep these busy!

This construction work was under the supervision of Mr. T. H. Robertson, assistant engineer of the Illinois Central Railroad, and Mr. E. H. Bruntlett, superintending the contract awarded to A. Guthrie & Co., Inc., of St. Paul.

"*Time* is the essence of this contract"—and by the selection and use of du Pont explosives and the employment of skilled labor and modern equipment the Guthrie Company acquires and executes such projects as that of the Illinois Central Railroad.

E. I. DU PONT DE NEMOURS & CO., INC.
Explosives Department
WILMINGTON, DEL.

Branch Offices:

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Du Pont Products Exhibit Atlantic City, N. J.

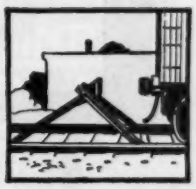
DU PONT EXPLOSIVES

BUDA
ESTABLISHED 1881

Railway Motor Cars

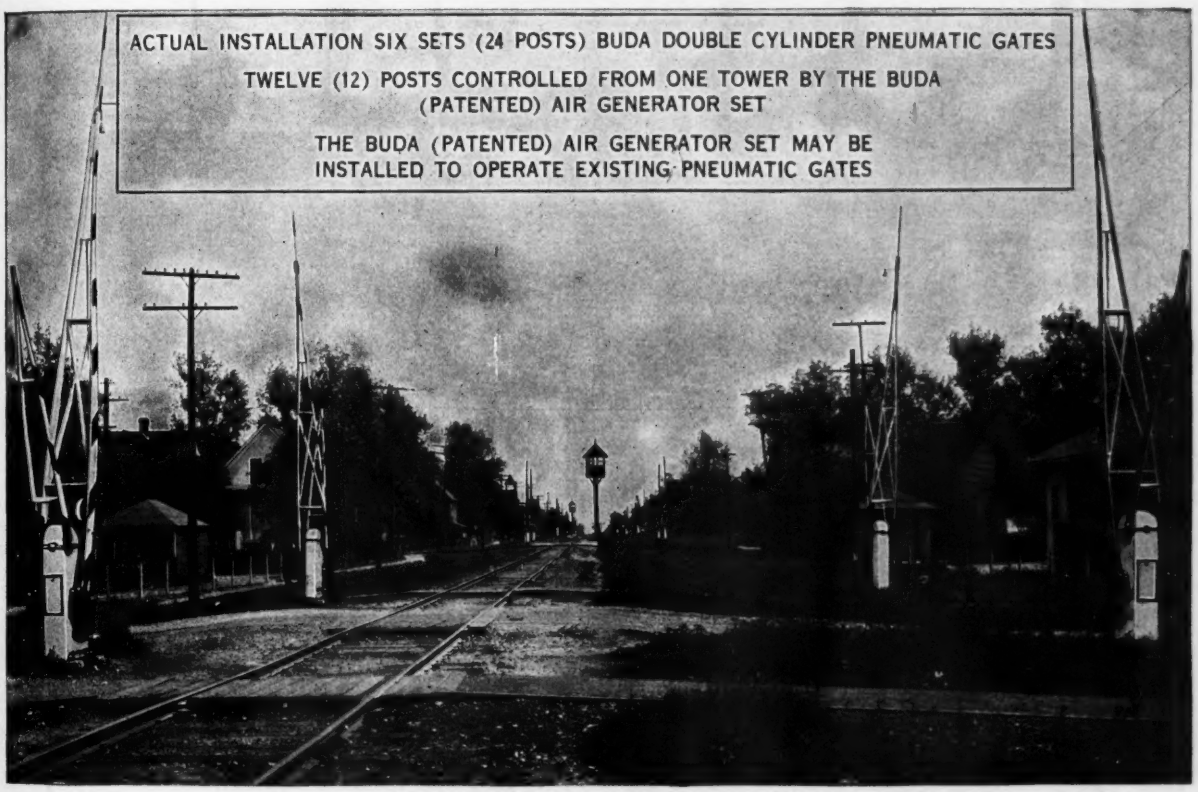
SAFETY CROSSING GATES

Electric, Pneumatic, Mechanical Lever
and Crank Types


All Steel Bumping Posts

A PROTECTIVE SAFEGUARD

at Street and Railway Crossings
Drawbridge Approaches


ACTUAL INSTALLATION SIX SETS (24 POSTS) BUDA DOUBLE CYLINDER PNEUMATIC GATES
TWELVE (12) POSTS CONTROLLED FROM ONE TOWER BY THE BUDA (PATENTED) AIR GENERATOR SET
THE BUDA (PATENTED) AIR GENERATOR SET MAY BE INSTALLED TO OPERATE EXISTING PNEUMATIC GATES

SIMPLE IN CONSTRUCTION

FEW MOVING PARTS

ACCESSIBLE TO ADJUSTMENT

LOW MAINTENANCE COST

Ratchet Jacks and Cone and Ball-Bearing Jacks

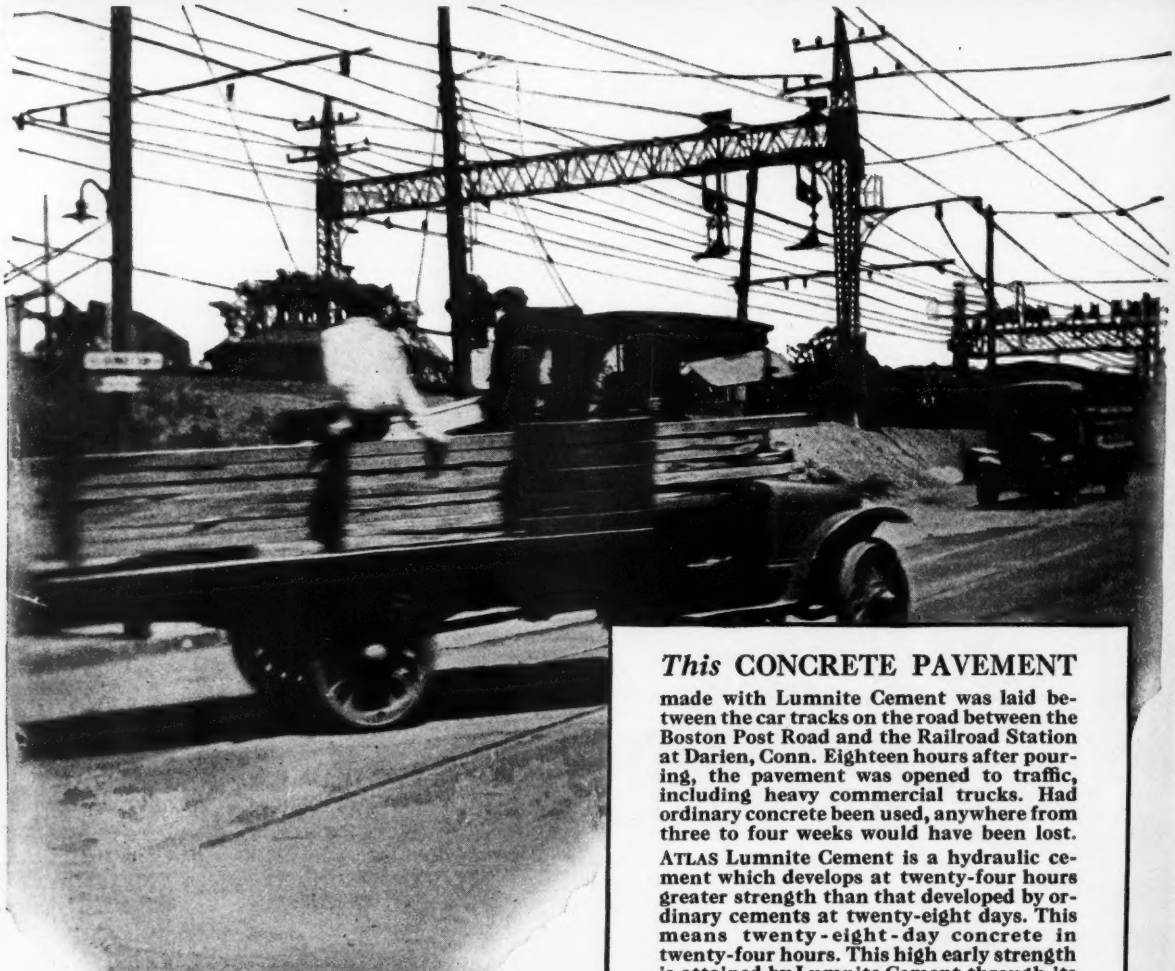
Track and Bonding Drills

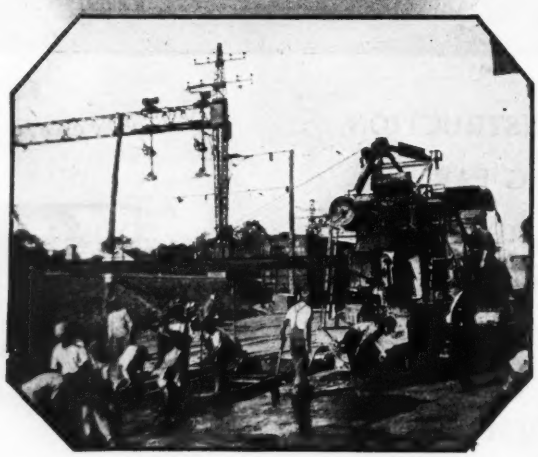
THE BUDA COMPANY

HARVEY [CHICAGO SUBURB] ILLINOIS

30 Church Street NEW YORK
Railway Exchange CHICAGO
Railway Exchange ST. LOUIS
664 Mission St. SAN FRANCISCO
LONDON

LUMNITE





This CONCRETE PAVEMENT

made with Lumnite Cement was laid between the car tracks on the road between the Boston Post Road and the Railroad Station at Darien, Conn. Eighteen hours after pouring, the pavement was opened to traffic, including heavy commercial trucks. Had ordinary concrete been used, anywhere from three to four weeks would have been lost.

ATLAS Lumnite Cement is a hydraulic cement which develops at twenty-four hours greater strength than that developed by ordinary cements at twenty-eight days. This means twenty-eight-day concrete in twenty-four hours. This high early strength is attained by Lumnite Cement through its principal ingredient, obtained from high-grade aluminum ore (Bauxite).

Lumnite is adapted to the various uses of concrete and is mixed and manipulated in the same manner as Portland Cement. An additional advantage of Lumnite is that it can be used in much colder weather than can other cements.

LUMNITE STRENGTH

Compressive tests by the Robert W. Hunt Company.

	1 LUMNITE 3 STANDARD OTTAWA SAND	1 LUMNITE 2 SAND 4 PEBBLES	1 LUMNITE 3 SAND 6 PEBBLES
1 Day	4789	3441	2071
2 Days	4906	3818	2444
3 Days	4940	4127	2598
7 Days	4985	4391	2663
28 Days	5005	4462	2691

(Each value represents average strength in compression of 3 specimens in lbs. per sq. in.)

CEMENT

saves 27 days

LUMNITE Cement makes twenty-eight-day concrete in twenty-four hours without the use of artificial accelerators. Lumnite effects big savings in time, for railroad construction and emergency work where early loading and use of a concrete structure are vital. Reconstruction or concrete repairs may be made one day and put in service the next with minimum interference with traffic, shop work, use of terminals, yards and roundhouses. Forms may be removed from foundations, walls and abutments in twenty-four hours, and from beams and girders in three days.

Lumnite time saving is valuable in the construction or repair of station platforms; floors in roundhouses and freight stations; engine or machine foundations in shops; turntable pits; renewal of ash pits; roadways under traffic; concrete piers and abutments.

Lumnite Cement is *not* "quick setting," but allows the normal time required for mixing and placing in forms. Its high early strength develops with great rapidity after the initial set has been attained.

With the use of Lumnite, form costs are greatly reduced by the more frequent use of the same form material; equipment can be released sooner for the next operation; labor is needed but a fraction of the time formerly necessary.

While Lumnite is a new product in America, cements similar to Lumnite have been used successfully in Europe for more than ten years wherever in concrete construction there is required high early strength, or resistance to the chemical action of sea water or sulphate-bearing ground water. Today Lumnite is available in any quantities.

A sample will gladly be furnished for testing purposes or for any small trial use

Send this coupon TO DAY

Please send detailed information on the use of LUMNITE, *for*

.....

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.....
(NAME)

.....
(ADDRESS)

THE ATLAS LUMNITE CEMENT CO.

25 *Broadway,* NEW YORK CITY

Hyatt bearing equipped No. 16 inspection motor car manufactured by the Kalamazoo Railway Supply Company, Kalamazoo, Mich.

Looking Ahead

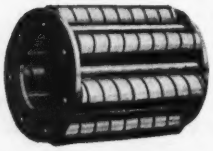
FAR-SEEING railway maintenance men are insisting on equipment that has proved its ability to stay on the job and to stand up under the increasing demands of future service.

In furnishing maintenance cars that meet this requirement The Kalamazoo Railway Supply Company builds Hyatt roller bearings into them as standard equipment.

Not only do these bearings provide the strength that insures long life and dependable performance, but their uniformly easy turning results in definite operating advantages and economies.

By eliminating plain bearing friction, Hyatt bearings insure smooth running and effect valuable savings in gasoline and in lubrication costs.

See your car manufacturer for Hyatt equipped cars and Hyatt bearing replacement boxes for modernizing your old plain bearing cars.



HYATT ROLLER BEARING COMPANY
NEWARK DETROIT CHICAGO SAN FRANCISCO
WORCESTER PHILADELPHIA PITTSBURGH
CLEVELAND MILWAUKEE

HYATT ROLLER BEARINGS FOR RAILWAY MAINTENANCE CARS

Cyclone

"GALV-AFTER" CHAIN LINK

Fence Fabric

SUPER-PROTECTION

First—the development of fencing for industrial Property Protection.

Now—the development of Protection for the fence.

Super-Protection—Protection for both property and fence.

Cyclone "Galv-After" Chain Link Fence Fabric is Heavily Zinc-Coated (or Hot-Galvanized) by Hot-Dipping Process AFTER Weaving. Resists corrosion. Lasts years longer. No annual painting required. The economical, enduring enclosure for railroad property.

Cyclone Iron Fence is widely used by railroads—as inter-track fence, park enclosures, etc.

Write nearest offices, Dept. 39, for complete information

CYCLONE FENCE COMPANY

Factories and Offices:
Waukegan, Ill., Cleveland, Ohio, Newark, N. J., Fort Worth, Texas, Oakland, Calif. (Standard Fence Co.), Portland, Ore. (Northwest Fence & Wire Works).

The Mark of Quality Fence and Service

Cyclone "Red Tag" Fence and Products

PROPERTY PROTECTION PAYS

It's easy now!

with the new Genuine Barrett Tripping Device

GET acquainted with this, the newest genuine Barrett track jack. It's truly a one-man jack. It makes tripping so easy and positive that one man can trip the jack under loads formerly requiring two men. The tripping device is simplicity itself. It is quick, safe, and so placed inside the base that it cannot be broken or lost.

It is the most notable improvement in tripping devices produced since the appearance, over 30 years ago, of the original Barrett No. 1, which has since become the standard of the world's railroads.

Due to the high grade materials used, as well as the improved design, high capacity—15 tons—has been combined with light weight—only 58 pounds.

The severest tests have proven this jack a most outstanding success, meeting the most severe requirements laid down by practical railroad men.

Ask for illustrated pamphlet and free demonstration

The
Duff Manufacturing Company
Established 1883
Pittsburgh · Pennsylvania

Genuine Barrett

Track Jack No. 1-A

PATENTS APPLIED FOR

Weighs only 58 pounds

ARMCO Culverts *in* Railway Service

No. 10 of a Series

Location: Main line of well-known Western Railway.

Traffic: Transcontinental freight and passenger.

Installation Data: A 10 gauge, 60-inch ARMCO Culvert. Fill approximately 56 feet of rock and gravel. Installed 1920.

Condition: Excellent. No corrosion or distortion. Inspected and photographed 1922.

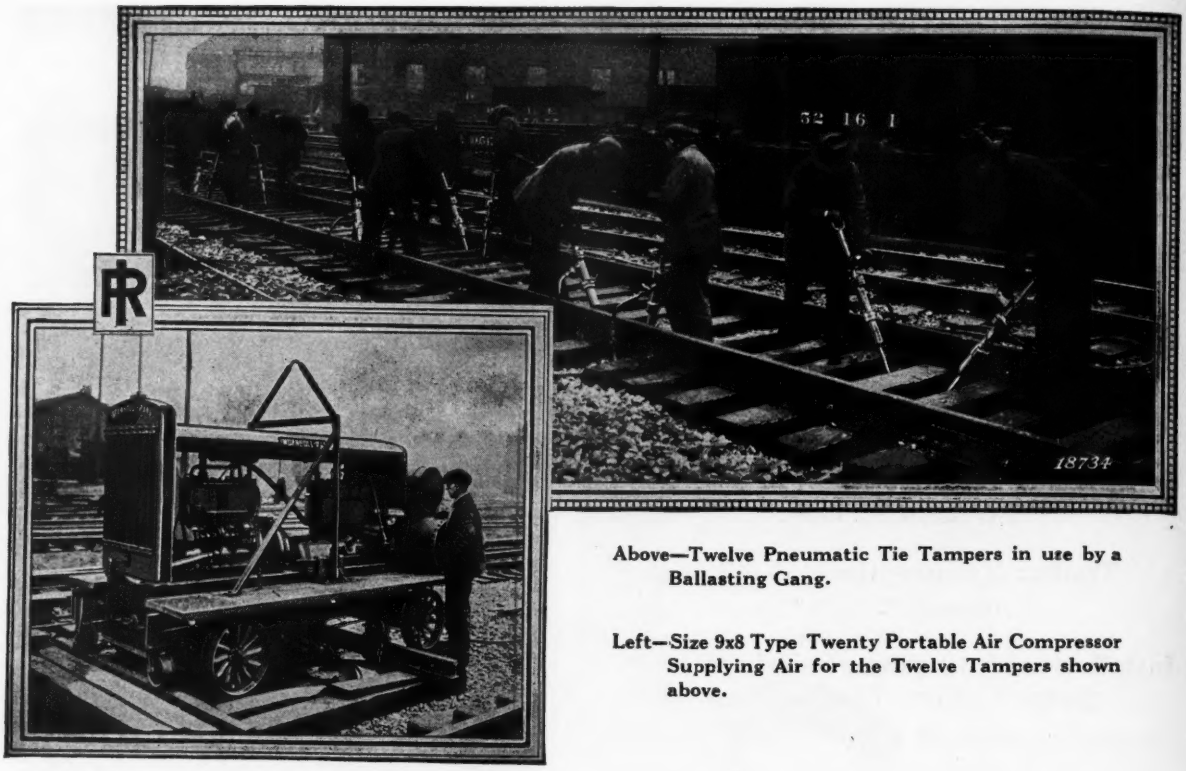
Remarks: The road under which this culvert is installed has used ARMCO Culverts since 1909. This particular ARMCO Culvert is one of several hundred installed under the main tracks in 1920, and shows the confidence in ARMCO Culverts on the part of railway engineers who have thoroughly tested them in service.

There is a manufacturer in almost every state and in Canada, making Culverts, Flumes, Siphons, Tanks, Roofing, etc., of genuine, rust-resisting Armco Ingot Iron. Write for full information and nearest shipping point on products in which you are interested

ARMCO Ingot Iron

ARMCO CULVERT & FLUME MFRS. ASS'N, 215 North Michigan Avenue, Chicago

ARMCO CULVERTS



Above—Twelve Pneumatic Tie Tampers in use by a Ballasting Gang.

Left—Size 9x8 Type Twenty Portable Air Compressor Supplying Air for the Twelve Tampers shown above.

MORE TRACK TAMPED PER MAN OR PER DOLLAR

Actual records of track work show that with pneumatic tie tampers three to five times as many feet of track are tamped per day as by hand tamping.

The tamping is more uniform, considerably more ballast is tamped under each tie, and the ballast is tamped harder. The result is that the track is put in better line and surface in the beginning and remains so for a much longer period than is possible with any hand tamping.

Ingersoll-Rand Pneumatic Tampers not only speed up the tamping but lighten the work. Less effort is required to hold and guide the air tamper than to swing a pick or bar.

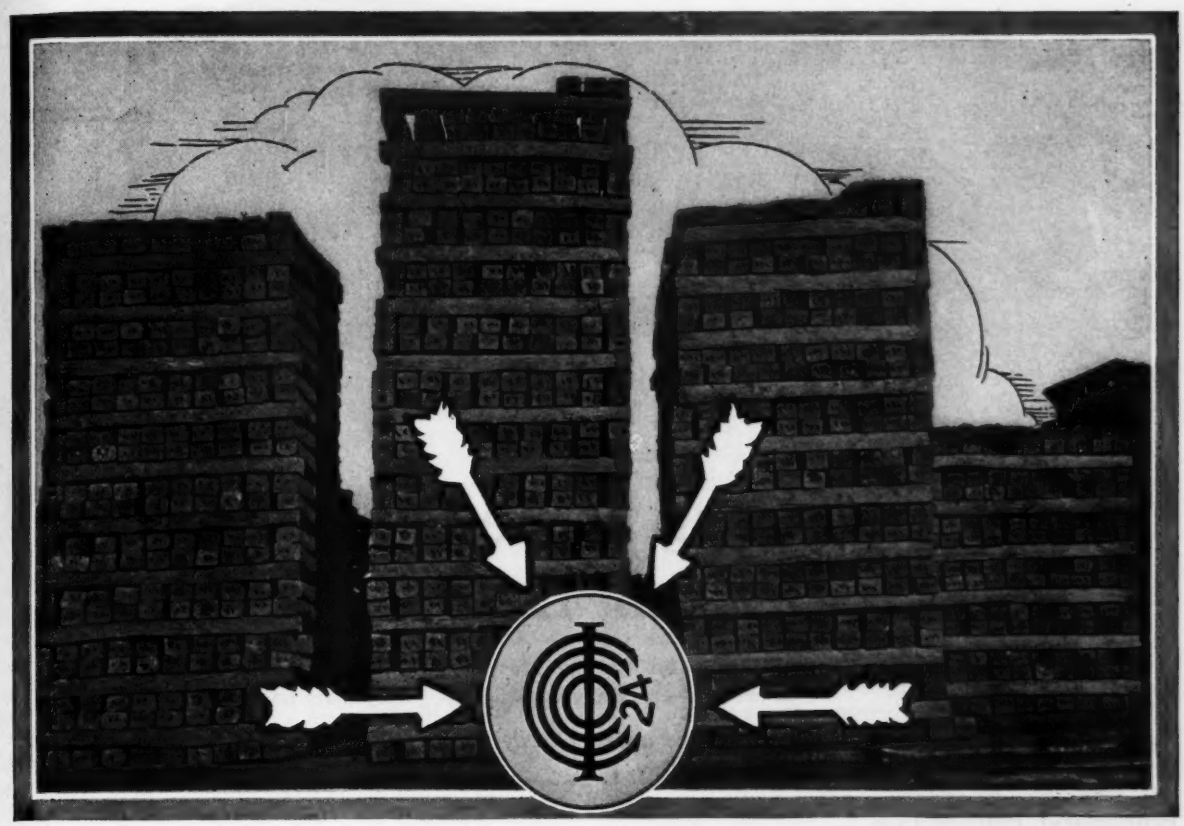
INGERSOLL-RAND COMPANY, 11 Broadway, New York

Offices in all Principal Cities the World Over

For Canada refer Canadian Ingersoll-Rand Co., Ltd.

260 St. James Street, Montreal, Quebec

Ingersoll-Rand



Note the uniformity of these Grade 2 and 3 ties and how carefully they are stacked high from the ground on creosoted poles.

The 18 Karat Mark on Ties

THE railroad that is burdened with the expense of decayed, over-graded, or inferior ties should try ***International*** Tie Service. This service eliminates the uncertainty of tie buying, for ***International*** Tie Service is confined to the sale and delivery of sound, full size, Standard Specification Ties, marked with the ***International*** dating nail—the 18 Karat Mark of Tie Quality placed in every tie.

This dating nail not only insures protection to your investment at the time of initial purchase of ties, but results in a saving in track maintenance due to longer tie life and fewer tie renewals, either of which is big enough and positive enough to command your thorough investigation.

Contract with International now—the future will thus be assured

International Creosoting & Construction Co.

General Office—Galveston, Texas

Plants: Texarkana, Texas Beaumont, Texas Galveston, Texas

International

Standard Specification Ties

Quick Dumping Necessary on Busy Main Lines

Substitute AIR for LABOR

Economical Performance on a Great Variety of Work

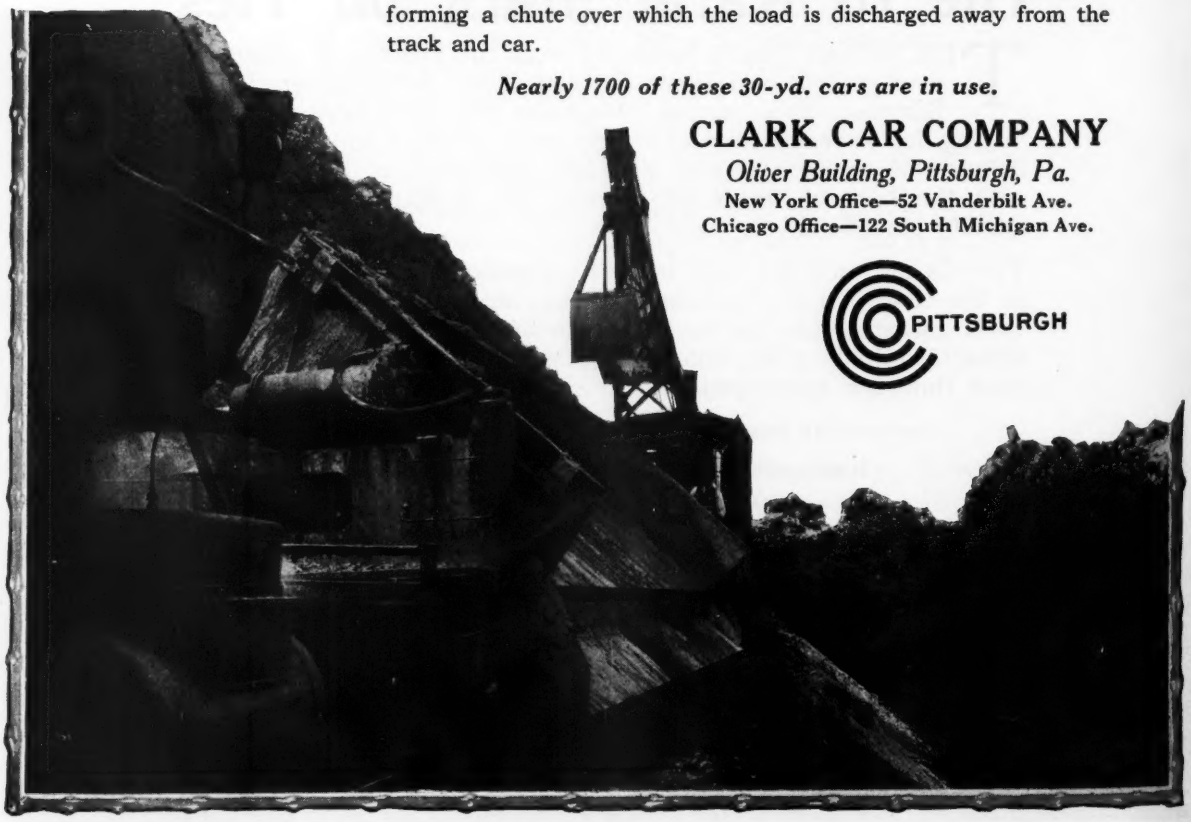
TIME is an important factor in railway ditcher and steam shovel service—especially working along busy main lines.

Cars must be loaded quickly, but equally important they must be unloaded quickly.

Air Operated Extension Side Dump Cars, which can be unloaded almost instantaneously, are meeting successfully these requirements —and more, they are saving both time and labor.

By turning the handle of the control valve, the car body rolls to the side and during this operation the side of the car turns out and down forming a chute over which the load is discharged away from the track and car.

Nearly 1700 of these 30-yd. cars are in use.



CLARK CAR COMPANY

Oliver Building, Pittsburgh, Pa.

New York Office—52 Vanderbilt Ave.
Chicago Office—122 South Michigan Ave.

PITTSBURGH

Railway
Engineering and Maintenance

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CAMP CARS AND MEN

THE FAILURE of the railways to improve the character of the camps in which they house their floating gangs is an indication of their lack of contact with modern tendencies in the treatment of labor. During the war with its active competition for men there was a distinct improvement in the character of railway camps, brought about by the fact that labor could not be secured otherwise. Since that time the demand for men has been less and many of the roads have returned to their old practices. In taking this backward step they are failing to recognize and profit by the experience of other large industries which have found that it is good business to provide attractive housing facilities for those of their employees who are dependent upon them for this service. As a result, the railways are not securing their share of the better class of men who accept railway work only as a last recort.

The Western Union Telegraph Company is one of the companies that has followed a different policy. With more than 100 gangs in the field constantly its forces compare favorably in size with the floating forces on a large railway. Its labor is drawn in general from the same sources as much of the skilled and unskilled labor in railway service. It faces the same problem as the roads in the necessity for housing these men and in the further necessity of providing camps which can be moved readily from one place to another. Its conditions are, therefore, comparable with those on the railways.

As indicated in an article published elsewhere in this issue the Western Union has found it advisable to discard the box car which has been condemned as unfit for the transportation of freight but which is still the standard unit of camp equipment on most railways. They have also learned that the provision of hot and cold running water, shower baths, heated cars and electric lights are appreciated by the men and are a definite factor in holding in service desirable unskilled, as well as skilled, employees.

Railway officers are giving much attention to the personnel problem today. As far as the maintenance of way department is concerned there is no greater opportunity for constructive work of this character than in the improvement of the facilities in which many employees must live, for which facilities they are dependent on the railways because of the character of their work. many of these men are as permanent employees as those in the shops and elsewhere. Even with temporary summer forces, however, good camps are of great assistance in attracting farmer boys and other high class local labor while a road's reputation for good camps extends into the labor centers and enables it to compete more successfully for such of its labor as is recruited in this manner.

In these days, when the relations of employer and employee are being stressed more than ever before, the railways owe it to those of their employees which are dependent on them for their housing facilities to provide equipment of proper character. However, entirely aside from this obligation the provision of modern facilities is good business for it will yield large returns in the increased efficiency of gangs. Local supervisory officers can do much to secure proper consideration of this subject on their roads by calling attention to the beneficial effect of better camps.

GOVERNMENT OWNERSHIP AND RAILWAY EMPLOYEES

During the fourteen months that I was director-general of railroads I felt a direct responsibility to all the railroad employees of the country, and I tried to the best of my ability to study their troubles and their needs. Federal control was a war measure. The law which established it set aside all usual methods of government action. The director-general had practically absolute power to raise rates and wages and change working conditions for the purpose of federal control, without consulting Congress, the Interstate Commerce Commission, or anybody else.

My judgment, based upon my studies of this matter, leads me to conclude that the employees have far better chances to promote their interests under the plan we now have of private operation of railroads with close government supervision. In forming this opinion during federal control I had the benefit of the experience and advice of W. S. Carter, who was for many years the chief of the Brotherhood of Locomotive Firemen, and who had a very clear and sound understanding of the interests of railroad employees.

I think that by having intelligent labor organizations that will co-operate in good spirit with railroad managements and by having what is equally necessary, railroad managements which will co-operate in good spirit with railroad labor organizations, we will have a situation where the employees will have better pay and working conditions and the public will have better service and at a lower cost. *From an address by Walker D. Hines to Great Northern employees at Minneapolis, Minn., on August 7.*

NEATNESS A GAGE OF EFFICIENCY

IT IS a rule of Henry Ford that a man who is not neat in his work will be inefficient and careless and as such has no place in his organization. His various industries throughout the country are, therefore, examples of neatness, characteristic of which is the outfitting of employees in his central power house at Detroit in white suits. This is not an idle whim of a man who is able to enforce arbitrary regulations on his employees because of the payment of wages above the scales prevailing in those communities. Rather, it is the result of the observation of large numbers of men at their work and as such is worthy of careful consideration by the railways and other industries.

A survey of railway employees, and particularly those in maintenance of way work, will bring one to the same conclusion. The foreman whose work is done neatly will almost always be found to be careful in the use of material and efficient in the handling of his men. His accident record will also be found to be low. On the other hand, the man who is untidy in the conduct of his work will by the same characteristics be careless and wasteful in the use of material and inefficient in the employment of labor.

The consideration of these important characteristics in men is of particular importance in maintenance of way work, for the men in this branch of service work largely in small groups with little supervision other than that of their foreman. Small wastes are not, therefore, detected readily nor, if detected, corrected easily. The responsibility of supervisory officers for the selection of foremen is greater, therefore, than in the shops, where it is possible to watch the operation of gangs more closely. Supervisory officers also should not lose sight of the fact that the neatness with which their sub-divisions and divisions are maintained by the foremen under their supervision is an index of their own efficiency and that many foremen look to their supervisors as examples for the conduct of their individual work. In general, neatness in the conduct of work requires little or no additional time, for it involves merely the cleaning up of work at the time it is done. In fact, the consistent following of this policy will actually save work since it will prevent waste and reduce expense.

CANTING OF RAIL INCREASES IN FAVOR

AN INTERESTING indication of the trend of railway practice in the United States and Canada relative to the canting of rail is afforded by a comparison between the results of a survey of present practice, which is published on a following page of this issue, and those of a similar survey made a decade ago, which was published in the Maintenance of Way section of the *Railway Age Gazette* for August 21, 1914, page 351. The earlier survey showed that only two roads of 24 questioned were then following this practice and that only three or four others looked on it with any degree of favor, while the remainder were opposed to it. A similar survey of present practices in this respect on 36 representative roads, including some of those referred to in the earlier survey, shows that 21 of these roads were now canting their rail and favor this practice, while six others have adopted it experimentally and only nine were not now following it. This demonstrates the change in the attitude regarding this practice which has occurred during the last 10 years and indicates that it is no longer regarded as an unnecessary refinement by the majority of maintenance men.

This trend is indicative of the development in track construction and maintenance which is being evidenced in numerous other ways. There has been a marked transition from untreated to treated ties in this period and this has made the use of tie plates essential. These, in turn, have given a greater permanence to the position of the rail and have enabled it to be held more accurately to the position in which it was laid originally. Also the character and intensity of the load to which rail is subjected and the service which it is rendering have been studied more closely within recent years than ever before, both in an effort to reduce the number of failures and to increase the normal service life. These developments have had their influence on many details of track construction, among which has been the canting of the rail.

The increasing number of roads which are looking with favor on the practice of canting their rail and the results which are being secured corroborate the experience of practical track men who found long ago that the adzing of their ties to "turn the rail in" reduced the amount of work required to hold the rail to proper gage. The marked increase in the canting of rail which has taken place in the last few years is an indication of the fact that track maintenance is being placed upon a more scientific basis and that as it continues to receive careful attention other refinements will be developed which will still further increase the servicability of the track and decrease the cost of its maintenance.

REPLACING TURNTABLES

THE period of time during which a roundhouse must be out of service to permit the replacement of an old turntable by a new one of greater length is dependent upon a number of considerations. Among these are the physical obstacles encountered, the character of the preparatory work, the completeness of the plans for the actual change, the amount of erection equipment available and the co-operation accorded by those responsible for the operation of the engine terminal. It is also dependent upon the amount of money which can be spent on the work over and above the outlay necessary to do it in the cheapest way regardless of time. However, it would seem that the expenditure necessary to do the work most expeditiously need not necessarily be much greater than that required to do the work in a longer time.

One of the most remarkable records in turntable replacement is that obtained by the Southern Pacific at Roseburg, Ore., which is described on another page of this issue. This performance is worthy of careful study by all whose duties require them to deal with similar problems. For the same reason it is not out of place to point to several features of the work which played an important part in its success.

Of prime importance was the obtaining of sufficient hoisting equipment, namely, a locomotive crane and two large capacity derrick cranes (wreckers). The latter were able to lift the new and old turntables bodily, thus obviating the need of the laborious teetering process and cribbing construction often resorted to with an attendant loss of much valuable time when only one piece of hoisting equipment of limited capacity is available. Another important item was the use of pneumatic tools in dressing the top of the old center pier, thereby reducing the time occupied by this portion of the work which much be done, of necessity, after the old center has been removed and before the new one can be set. But

of more importance than the advantages enjoyed through the availability of adequate equipment was the careful planning of the work so clearly evidenced in the description referred to. Not only was the preparatory work done with exceeding care so that everything was in readiness for the actual work of replacement but the various gangs had been so well organized and drilled that each member knew what was expected of him during every stage of the work. This is clearly evidenced by the clock-work regularity with which each item of the program was carried out, as recorded in the time schedule appearing in the article. This record is an eloquent demonstration of the old adage that what is worth doing is worth doing well.

THE HUMAN ELEMENT

THE EXTENT to which the success of a railroad is dependent on the human element has been variously estimated. We will hazard no actual percentage here but there is common agreement that the figure is high. This does not mean that the fortunes of a railroad depend alone on the calibre of the higher officers. Rather it means that the net results are represented by the sum total of the interest, spirit and effort put into the work by the entire organization. Foremen are often inclined to feel that the success of their work is controlled almost entirely by the number of the men assigned to them. In taking this attitude they belittle their own importance in the general scheme of railway maintenance because it is well known that one foreman will obtain better results with the same force allotment than are obtained by either his predecessor or successor. Much depends upon the man.

It has also been said that there is no parallel to a foreman's position outside the railway organization. This is no longer true. With the increased importance of public highways some states have placed highway maintenance work in the hands of patrolmen, whose position corresponds very closely to that of the track foreman except that he usually works alone. He functions as both foreman and gang save that he is often provided with a team of horses with which to pull a grader or to haul gravel or stone. It is interesting, therefore, to note the observations which have been made of the performance of these patrolmen. Here again we find that the section of road under one maintainer will often be found in a definitely better or poorer condition than when it was maintained by some other man. Through greater industry, better understanding and more careful disposal of his time, one man becomes much more successful than another in repairing the damage done by traffic.

This parallel has not been drawn with the idea that work on the highway is entirely comparable with that on the railway. Surely the work of the track foreman is more complicated and his responsibility far greater but in each case the man is engaged in *maintenance* in every sense of the word. Each repairs the damage done by traffic, each must search out the worst spots and correct them before the conditions become too bad. Both fight the same enemy—water.

The justification of this comparison lies in the lesson it drives home in the value of the human factor. It should give the foreman a new sense of the importance of his position and the opportunities which it affords him for the exercise of intelligence and understanding in the interests of his employers. Supervisory officers may well impress upon their foremen how much the success of their work depends upon what they individually put into it.

New Books

Proceedings of the American Railway Engineering Association. 1,382 pages, illustrated. 6½ in. by 9 in. Bound in cloth. Published by the Association, 431 South Dearborn street, Chicago.

This volume contains the proceedings of the twenty-fifth annual convention which was held at the Congress hotel, Chicago, on March 11-13, 1924. It includes the reports of 24 committees, requiring 1,150 pages, and the discussion of these reports on the floor of the convention, which required 156 pages additional. Although this association is unique among organizations of this character in the amount and character of the work done, the reports contained in this volume established a new record for their practical value to the railways. Because of the large number of subjects on which reports were presented, it is impossible to refer to all of those of special merit. Attention may be called, however, to the reports on fuel oil installations, the arrangement of large passenger station facilities and the specifications for steel bridges, which are worthy of special reference.

Proceedings of the American Wood-Preservers' Association. 375 pages, 6 in. by 9 in. Bound in cloth. Published by the American Wood-Preservers' Association, 1146 Otis building, Chicago. P. R. Hicks, secretary.

This volume, as the title indicates, presents the transactions of the American Wood-Preservers' Association at its annual convention held on January 15, 16 and 17 at Kansas City, Mo. It not only contains the papers and committee reports presented there but includes the complete discussion following their presentation. The contents are typical of the reports of previous conventions of this association and comprise a record of the most recent progress in this field, not only in outlining the developments of scientific studies relating to the technology of this industry and the development of more efficient and effective plant methods, but in recording the service results obtained with treated timber and the current efforts being made to promote its greater use. The reports this year cover such matters as the adoption and revision of specifications for creosote oil and other preservations and specifications for treating processes as applied to different classes of timber. Of particular interest in this volume as indicating the trend of the times are several reports and comprehensive descriptions of the use of mixtures of creosote and petroleum oil and emulsions of zinc chloride and petroleum oil, together with service records of ties subjected to this form of treatment in addition to the usual service test reports which appear in the proceedings from year to year. Owing to the fact that the statistics on the quantities of wood treated and preservatives used in the United States in 1923 were not available at the time that this volume was published, these statistics, which have been an important feature of the proceedings of this association for many years, will appear in a separate volume later.

SOME ADVANCED IDEAS.—In an inquest in a court in Massachusetts following a train accident believed to have resulted from the placing of rocks on a railway track on a curve by two small boys, the judge offered several recommendations which, in his opinion, would tend to reduce accidents from this cause, among other suggestions was that the radius of curves be increased, the curve in this case was one of only four degrees, and that the right-of-way be fenced, presumably sufficiently high and tight to keep small boys off the right-of-way.

Canadian Pacific Lays 29.7 Miles of 85-lb. Rail in Two Days

Further Developments of Method Previously Described Permit of Greater Output of Working Forces

THE CANADIAN Pacific recently completed its rail program for this season on Eastern Lines by laying 29.7 track miles of 85-lb. steel in two days. This work consisted of two stretches of track 9 miles apart on the single-track line between Mattawamkeag, Me., and Brownville Junction and was done under light traffic. Old 80-lb. rail was renewed with 85-lb., using a method which involved some interesting changes in the plan that was described in a previous article on the rail laying methods of this road which appeared on page 476 of the December, 1923, issue. About 220 men, including camp cooks, helpers, etc., were employed. The rail was laid in units of three rails each at an average rate of approximately 1½ miles of track per hour, the total actual working time for the two days being 17 hr. and 45 min. At several periods a mile of track was laid in 20 minutes.

The Rail Is Unloaded Close to the Ties by Means of Roller Hooks Suspended from the Side of the Car

The work which is described here represents one of a number of stretches of track on which rail was renewed, the lengths varying from 8.6 miles to 57 miles. With the exception of the 29.7 miles where 85-lb. steel was laid, the renewals consisted of 100-lb. rail under a variety of conditions of traffic and track. It is interesting to observe that the shorter stretches were handled as efficiently as the longer. For instance, one section of 8.6 miles was completed in one day and a stretch of 19.6 miles in two days. An average of nearly 7 miles per day was made for the season, all days on which rail laying was under way either on full or part time being included as a full day.

Preparations for Laying Rail

The basis of the method is the performance of all work that it is possible to do, before and after the new steel is in track, thus reducing to the minimum the number of tasks which must be done during the actual period of laying the rail. The first of the preliminary work consisted of chaining the track carefully and marking the rail according to the "rail units" which were to be handled by the tong men. When replacing 80-lb. rail with 85-lb. rail the track was laid off in units of 3 rails plus ¾ in. or 99 ft. ¾ in. Both rails in track were marked and where short rails were needed, that also was marked on the side of the rail. This measuring was usually done by the foremen. This marking, which is one of the improvements over the method previously described, insured an accurate distribution of the rail, and eliminated almost entirely the unloading of excess rail, obviating the labor and work train costs due to the necessity of picking it up again. It also had an effect upon the amount of work which the setting up gangs were able to perform in a day.

The rail was distributed from the flat cars on which it was received from the mills by means of roller hooks suspended from the side of the cars. Both long and short hooks were used and the rail was unloaded on both sides at the same time. By this method from two to seven cars were unloaded at a time, depending on the character of track and the speed of the work train. The organization included about four men to a car and from 25 to 30 cars a day were unloaded in rough country with considerable curvature and from 35 to 70 cars in level country and light curvature. The steel was rolled across the car by two men equipped with special roller bars and, at the direction of a man on the ground who was watching the rail marks, it was turned over into the roller hooks from which it slid out onto the ballast shoulders close up to and approximately parallel with the ends of the ties. Where short lengths were marked, it was the usual practice to drop a 27 ft., a 30 ft. and a 33 ft., in order to take care of any situation which might arise when rail is being laid.

Throwing the Old Rail to the Inside

The distribution or unloading of the rail was followed by the setting up of the rail and the bolting of it into units. For the first operation, "three-man" rail layers were used, five men and a foreman being assigned to each machine. Each machine and crew averaged about 5 miles of rail on one side per day. The rail was placed on its base along the ballast shoulder, near to the ends of the ties, and located accurately according to the marks. This was done to simplify the lifting in of the rail and to obviate any unnecessary

motions caused by moving the rail forward and then back as laid. After the rail had been set up in this way, it was bolted up into units of three rails each and, as the weather was hot, no expansion was put in at the two bolted-up joints, such expansion as would be necessary at the time of laying being put in at the third joint at that time. As soon as the rail was bolted up, it was turned over on its side with the head or ball of the rail resting at the ends of the ties.

The next and last step in the preliminary work was done immediately preceding the rail laying. At this

Tong Men Pick Up the Three Rail Lengths and Place Them on the Tie Plates

time, alternate spikes were pulled as well as all extra inside spikes on curves, so that all spiking would be uniform on curves and tangents. Broken spikes were pulled or driven down and spikes appearing to be difficult to pull were loosened. Joints were "broken" about every 20 rail lengths on curves and 40 on tangents, the bolts oiled and joints then replaced with extra nut locks on the bolts so that the nuts would thread only on the ends of the bolts. It will be noted that with the exception of marking the rail and some extra work entailed by the careful setting up of the rail, practically nothing was done which would not be done in other methods of rail laying, either as a preliminary or as a part of the laying operations.

The rail laying forces were divided into two gangs, one for each line of rail and the operation will therefore be described for one line of rail. The first operation was the rolling over of the three-rail unit onto its base, this turning over of the new rail bringing it to rest near the old rail. This was done by three men with rail forks equipped with extension handles. The remainder of the inside spikes were then pulled by a gang which did nothing but that work, after which the old rail was barred in by another gang following the spike pullers. The outside spikes and the tie plates were not disturbed. It was found that the setting up of the new rail preliminary to laying aided greatly in the barring in of the old, as it served as a fulcrum for the lining bars when starting the old rail. The close-in location of the new steel also permitted better walking and standing positions for the tong men who followed the barring-in gang.

Usually 28 tong men were used on each three-rail unit. These picked up each unit, swinging it over onto the tie plates and back against an expansion shim held against the last preceding rail end. The accurate location of the new rail eliminated almost all carrying of the rail by the tong men and made it possible to swing the rail into line without change of their individual positions while lifting. Thus the drudgery of the tong work was greatly reduced and the men were enabled to do more work. In this operation, the same tong men, with a few exceptions, were used throughout both days. The tong men were followed by the spikers who barred the new rail up against the shoulders of the tie plates and spiked it down in a safe but temporary way. From six to eight spikes to each rail length were driven in the old holes, leaving the track full spiked on the outside and from one-third to one-half spiked on the inside. The spikers were followed by the bolters who put on the remaining joints (every third joint) and bolted them up tight. As only every third joint was involved, the bolters were able to keep close up with the work, thus helping to keep the gangs well bunched.

The organization for this particular work varied slightly during the two days according to the needs and conditions which arose as a part of the procedure. In general, however, it remained practically the same and the following represents very closely the arrangement of the forces for one line of rail.

No. of Men	Duties
3	Unbolting rail for breaks (with motor car)
3	Rolling over rail onto ties
12	Pulling spikes
8	Baring in old rail
28	Tong gang in charge of foreman
14	Spiking
25	Bolting up rail
93	Total on one line of rail

In addition to the number, which totals 186 men, for both rails, there were 2 flagmen; approximately 10 men assigned to road crossings, making closures at switches, etc,; about 4 to 6 men on the work train, throwing out the old rail; and waterboys, camp cooks, helpers, etc., resulting in a total gang of about 220 men.

The old rail was thrown out of the center of the track and onto the shoulders of the ballast by means of a work-train and about five men. The ends of the strings

The Rail Gang Passing the Station at Lakeview

of old rail were barred over the new rail, after which the work train pushing a loaded flat car was run along the track crowding the old rail out. Small boxes built into the side frames of the flat car and containing oil soaked waste furnished the desired amount of lubrication at the point where the old rail and the track wheels were in contact. This work was done at a speed of about five miles an hour, the work train easily keeping

up with the rail laying although only working at odd times, and when it would otherwise have been idle.

The work of renewing the tie plates and full-spiking the track followed the rail laying operation closely, being carried out by a redistribution of the gangs. Tie plating was done under traffic the same as all the rail laying. The spikes were pulled, the old plates knocked out, the spike holes plugged, the ties adzed where needed, the new plates inserted and new spikes driven. Such lining as was necessary was done by tie-plating, to line, while frequent gaging was performed to insure the

The Old Rail Is Thrown Outside the Track by the Wheels of a Car

track being in proper line and gage. Rail anchors were applied following the tie-plating.

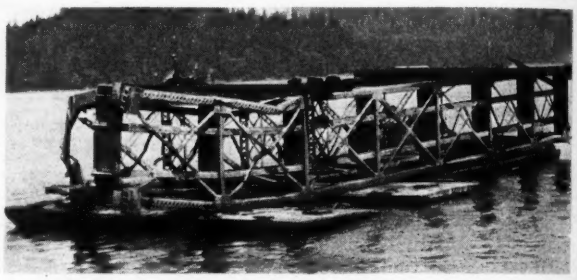
As the tie-plating is thus specialized, the work of completing the track, that is, renewing tie plates, adzing and full spiking were carried on at an average rate of from 60 to 75 tie-plates per man per day. The old rail was unbolted and picked up by a work train with air-operated hoists. With the exception of the labor involved in the driving and pulling of the six to eight temporary inside spikes, per rail, no work was done that

After the Passage of the Work Train Which has Thrown Out the Old Rail

would not be necessary with any method of rail-laying. However, by separating the tie-plating from the actual rail laying, it was found that the tie-plating, lining and gaging could be done better and more economically and that the postponement of these items permitted faster and more economical laying of the rail in track. After two seasons use of this method, it has been found to be cheaper than the methods previously used and reduced appreciably the number of days on which traffic was interfered with due to rail laying. It is felt, therefore, that it has produced a number of operating economies because of the lessened possibilities for train delays, slow orders, etc., the costs of which are difficult to estimate. Another factor, of both interest and importance, is connected with the labor involved. Through the use of this method the actual labor involved has been considerably reduced, the work with the tongs for instance, no longer being the drudgery which it formerly was. This was evidenced in the above work by the fact that the same men with a few exceptions handled the tongs throughout both days and on the second day were able to lay the last two miles of rail in one hour without any sign of fatigue.

An Unusual Bridge Problem

SHORTLY after midnight on the night of March 7-8 the steam schooner Martha Buehner, proceeding into Coos Bay, Ore., completely missed the 208-ft. opening provided by the drawbridge of the Southern Pacific and knocked the adjacent 180-ft. steel span into the bay. The subsequent official investigation proved that the drawbridge facilities were in proper condition and placed the entire responsibility for the occurrence on the steamer company. The Portland division mar-



The Span Was Floated on Three Barges

shalled the necessary forces and handled the emergency with dispatch, even utilizing radio for the transmission of orders. A Coos County ferry boat was pressed into service for the transfer of passengers and 52 hours later the gap was bridged by a temporary timber trestle and traffic restored to normal schedule.

At the conclusion of the official investigations, steps were taken to remove the submerged span and on April 24 a contract was let to Booth and Pomeroy of Portland, Ore., for the removal and dismantling of the span

Jacks Were Used to Raise the Span

and the delivery of its parts on cars ready for transportation to storage. The contractor drove a pile structure around the submerged span; lifting cables were then suspended from this structure and the span hoisted with hydraulic jacks clear of the water. Barges were then floated under the span, the pile structure was removed and the span on its barge supports was towed to a point where it could be dismantled.

Fifteen days were required for driving the piles and capping them with the timbers to support the required hydraulic jacks, 26 of which were used, with a total lifting capacity of 800 tons. This provided ample lifting power, since the bridge weighed only about 240 tons. The lifting operation was accomplished slowly, the span being raised a few inches with the jacks and then suspended from auxiliary cables while the jacks were lowered and the operation repeated. A total of 14 days was required to raise the span clear of the water. Two 200-ton and one 150-ton barges were then floated into position at low tide and with the coming of high tide took the entire weight of the span. The lifting structure was then removed and the span towed by two tugs to the Port of Coos Bay dock, a distance of about 2½ miles. Nine days later the dismantling was completed and the parts shipped to the Brooklyn shops for storage.

An inspection of the structure showed that about one-third of the members were crushed and twisted beyond repair and would require replacement with new material. Furthermore, all portions which had been submerged were thickly encrusted with barnacles, the removal of which presents a considerable problem.

We are indebted to W. H. Kirkbride, engineer of maintenance of way and structures of the Pacific system of the Southern Pacific, for the above information.

A System For Ordering Bridge Timbers

THE practicability of framing bridge ties before treatment to avoid cutting into the treated timbers at the time that they are placed in the structure has been definitely demonstrated by the Baltimore & Ohio,

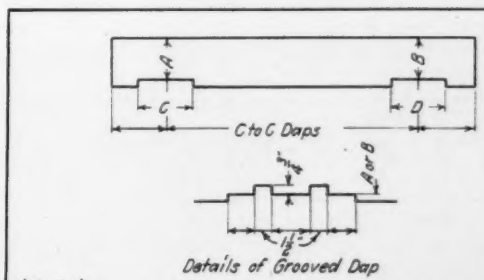
St. Louis DIVISION
BRIDGE NO. 316-10
SPAN 3rd FROM EAST END
TIE RENEWAL OUT OF FACE - YEAR 1924
Distance c. to c. Girders or stringers 8'-0"
Width, thickness, and length of all top flange cover plates
Top cover 9/16 x 14 x 51'-9"
2nd cover 9/16 x 14 x 62'-0"
3rd cover 9/16 x 14 x 91'-6"
Are there 2 or 4 lines of rivets in cover plates 2
Fill in spacing: 7 1/2" c. to c. or
If framing has to fit where there are no cover plates, fill in dimension of width out to out flange
Alignment over span: Tangent
If curve, give degree and superelevation
If spiral or easement, plan has to be furnished, giving alignment notes, and rate of run off for superelevation.
If footwalk on bridge, state which side.
Describe any unusual conditions, which have to be met in framing of ties:
If ties are ordered, state requisition numbers, and items.
Master Carpenter Division Engineer

The Master Carpenter Fills Out the Information Sheet

not only as applied to the ties used in pile and timber trestles, but also for those used in the floors of steel bridges. The sizing of ties to a uniform depth solves the problem with respect to timber trestles, but floors on steel bridges introduce more or less complication since the ties must compensate for the irregularities in the top surface of stringers and girders and must fit over rivet heads and cover plates of varying thickness, and on bridges on curves must take care of superelevation, at least in part. However, this situation has been overcome by the introduction of a system of information and requisition forms with the aid of which the exact nature of the framing may be determined easily and accurately and indicated readily to those who must do the work.

Where a general tie renewal is required for steel bridges, the first step is to obtain correct information from the field. For this purpose, a standard information sheet has been prepared which is filled in from measurements taken by the master carpenter. As shown on the specimen sheet illustrated, this gives the spacing of the girders, the lengths of cover plates, the number of rows of rivets and the rivet spacing, the degree of curve and superelevation, if any, with a space to fill in descriptions of any unusual conditions which have to be met in the framing of the ties.

The information sheets obtained from the field are compared in the office of the engineer maintenance of



List of ties

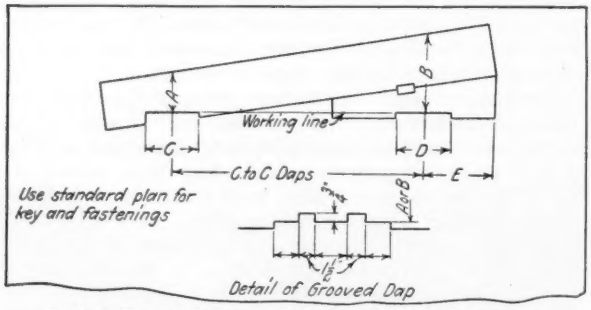
No.	Dimension	A	B	C	D	Remarks
12	Ties	7 3/4"	7 3/8"	12 3/4"	12 3/4"	No grooved dap
14	Ties	7 1/4"	7 1/4"	12 3/4"	12 3/4"	Grooved dap
20	Ties	6 1/2"	6 1/2"	12 3/4"	12 3/4"	Grooved dap

Requisition No. LM 5678 T
Mark XY-61
Ship to Division Engineer John Doe
Division
Bridge No. 61
Span 3 from E. End
North Track
Treated Ties - Renewal 192
Office. Engr. M. of W. Cincinnati, O

Order Blank for Ties on a Tangent Bridge

way with the bridge records. These field measurements in many cases give more correct information than the detail drawings could possibly do. For instance, a wider dap may be required due to over-run of the flange angles,

the spacing of girders may vary as much as ½ in. due to irregularities in shop work, and there may have been changes in curvature or superelevation of which the plans do not contain records.



Special Forms Are Provided for Special Conditions

The requisition sheet is filled in in the office of engineer maintenance of way. This is a standard form, which is a combination of a sketch of a typical tie, with a table in which the various pieces are listed, with the dimensions determining the dapping or framing. Space is also provided for filling in the requisition number, shipping mark, bridge number, spans, etc. One of the specimen sheets shows the typical form for tangent track. Other forms take care of special conditions.

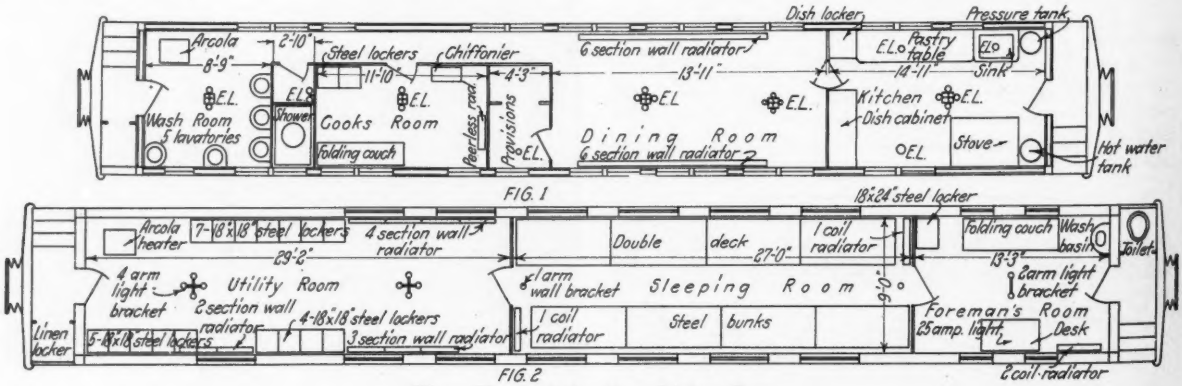
It is the practice to provide grooves in the ties where there are two lines of rivets in the cover plates, but in cases where four lines of rivets occur, daps are not provided. Instead, the ties are put in place on the girders, and after traffic has passed over them so as to mark the positions of the rivets, the ties are taken out and shallow holes bored in each tie to conform to the dents formed in the underside of the tie by the rivets.

The filled in requisition sheets contain the complete information required by the plant for framing and treating the ties from the time they are ordered until they are shipped out to the division. An important feature is the system of marking. Each is marked by a hammer stencil as soon as it is framed, this mark remaining visible throughout and after the process of treatment. Take as an example, the mark "X Y-61," "X" indicates the division, "Y" the sub-division, and "61" the bridge number. Consequently, if a shipment goes astray or ties are misplaced, the tie itself contains the necessary information for redirecting the shipment.

Western Union Uses New Camp Cars

By J. E. CREWS
Chief Clerk, Division Plant Superintendent, Western Union Telegraph Company, Chicago

AFTER several years of experimenting with various types of cars and several sizes of outfits camp car outfits provided by the Western Union Telegraph Company for boarding and lodging line construction and reconstruction forces have been standardized. They are constructed with the intention of providing not only economical boarding and living accommodations, but also clean, sanitary and comfortable homes for the men at all seasons of the year. The outfits are in use in all sections of the country, and are constructed so they will be as comfortable as possible in either extremely hot or cold weather.



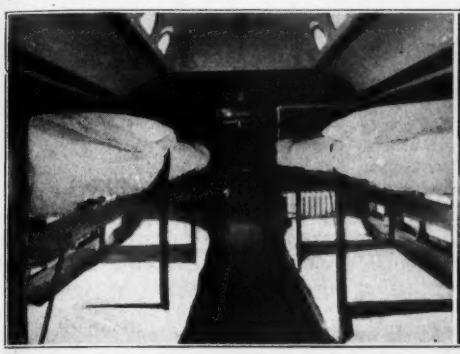
Floor Plans of the Two Living Cars

The standard outfit consists of three cars with accommodations for 16 gangmen, a foreman, a cook and a cook's helper. Outfits of this size were first placed in service in 1916, and practically no changes have since been made in the interior arrangement of the cars. Frequent changes have been made, however, in the equipment installed in these cars in an effort to make their operation more economical or to provide more suitable living conditions. Such new equipment was adopted as standard only after it had been given service tests and proved satisfactory.

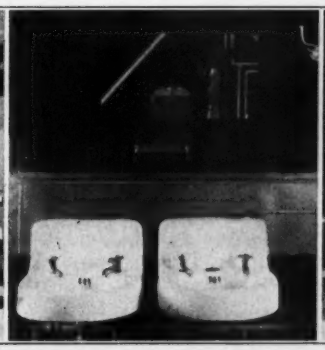
All steel tank cars with a capacity of from 8,000 to 10,000 gal. are provided for use with these outfits for maintaining an adequate supply of water when in service in sections of the country where water must be obtained from a distant source. These tank cars provide a sufficient supply of water for two weeks, under average con-

The cars purchased for this service are second hand and are obtained from various sources. They are inspected carefully before being purchased to insure that the general condition is such as to permit their being repaired and placed in condition for camp service at a reasonable cost. For dining and sleeping cars, Pullman type cars from 65 ft. to 75 ft. in length are used. This type of car is preferred to all others, principally on account of its length, and because its heavy construction and the fact that it has vestibule ends are also of advantage. For tool cars, 50-ft. box cars are used.

For dining cars, those approximately 65 ft. in length are selected, and are divided by partitions into rooms of about the following lengths: kitchen, 14 ft.; dining room, 20 ft.; grocery room, 5 ft.; cook's room, 17 ft.; shower bath room, 3 ft., and washroom, 7 ft. The longest cars available are selected for sleeping cars, preferably those in excess of 70 ft. in length. Such a car is divided by partitions into rooms of about the following lengths: locker and lounging room, 30 ft.; gang sleeping quarters, 27 ft. and foreman's room, 13 ft. The lengths of these rooms often vary slightly from the given dimensions on account of variations in the length of the cars used. In the case of the sleeping car any additional length available is always added to the locker and lounging room. The tool cars have but one partition which divides the car into a refrigerator and grocery room, and a tool and material storeroom. From 10 ft. to 12 ft. of this car is allotted for use as a refrigerator room.



Steel Bunks With Good Springs and Mattresses



Two of the Five Washbowls

The Foreman's Room with Desk and Bed

Cars Are Rebuilt in Shop at Chattanooga

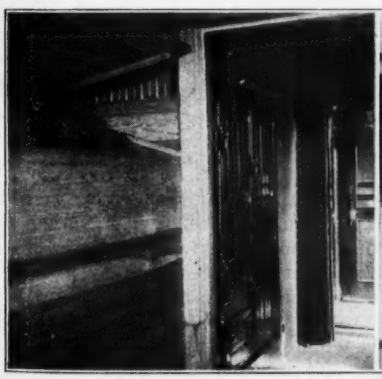
All the cars are repaired, remodeled, and equipped at one shop located at Chattanooga, Tenn. When cars are received at the shop for remodeling, all berths, seats, staterooms and partitions are torn out. The interior side walls are then repaired and made as smooth and plain as possible so they may be easily kept clean. The old headlining in the car is removed and replaced with a metal headlining. New maple floors are laid in both the dining and the sleeping cars. Partitions dividing the cars into the various rooms are constructed and made a permanent part of the car.

The exterior of the cars and the trucks are repaired and placed in first class running condition. New canvas roofs are placed on the dining and sleeping cars and new wooden roofs on the tool cars. All cars are equipped with double windows and with screens. Upper deck ventilators are put in good working condition and screened. Strong screen doors are provided for all exterior door-ways. Any other repair work required is done and the cars placed in condition so that they are generally in service three years or more before it is again necessary to shop them.

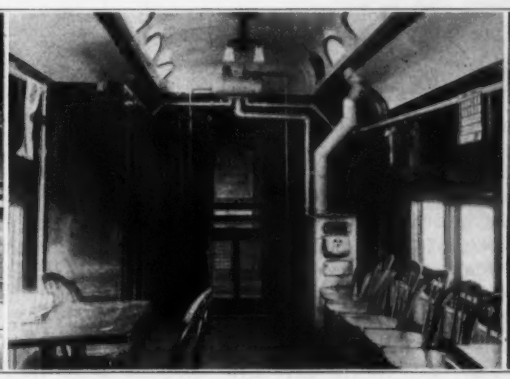
The interior woodwork of the dining and sleeping cars is stained a dark mahogany color and varnished. The headlining of these cars is painted a cream color. When the cars are first equipped, all the old exterior paint is removed and they are thoroughly painted and varnished. The exteriors of the tool and tank cars are painted and varnished with the same material as used on the dining and sleeping cars so that all of them will have the same appearance.

Heating, Lighting and Water System Provided

The dining car is equipped with a water system supplying both hot and cold running water at the kitchen sink, shower bath and wash basins. This is a pressure system, with the pressure tank and pump located in the kitchen. In the older outfits the pump is hand operated. However, the more recently constructed outfits are equipped with electric generating plants, and pressure for the water system in these outfits is furnished by a ¼-hp. motor driven pump. This system consists of two storage tanks suspended under the car, which have a combined capacity of about 800 gal. The two tanks are connected by an equalizing pipe. These tanks are wrapped with several layers of roll felt and boxed in to prevent freezing. As an additional precaution in extremely cold weather, provision is made for running hot water from the hot water boiler attached to the kitchen range into the storage tanks.



Coal Bin and Fuel Box in the Tool Car



The Living Room Has a Victrola, Table and Chairs

Electric Plant in Tool Car

The dining and sleeping cars are heated by Arcola water heaters, one in each car, located in a corner at one end of the car. Wall radiators are used and so placed as to insure an even distribution of the heat throughout the cars. To eliminate the danger of freezing, or the circulation of the heat being impaired during cold weather, the piping is so planned that at no place does it go below the floor of the car.

For several years the cars have been lighted by gasoline gas lamps, gas being generated in a small five gallon tank by a hand pressure pump and conveyed through fine wire pipe to the lamps. All outfits are now being equipped with 32-volt electric generating plants and storage batteries for providing light, and power for operating the water system. The generating plants and batteries are placed in the tool cars. Only air-cooled units are being installed as no heat is provided in the tool cars and there would always be the danger of a water-cooled unit freezing. The wiring of the cars is carried in metal conduit, which is exposed so that any repairs that might become necessary can be made readily. Some of these electric lighting systems have now been in service a year, and the indications are that they will meet all service requirements, and are more economical than either oil lamps or the gas system.

The Kitchen and Dining Room Are Clean and Meals Substantial

The dining cars are equipped with a large hotel type cooking range over which a metal hood has been installed to carry off the smoke and heat. The kitchen sink and the five wash stands are of white porcelain. The shower bath room consists of a small room entirely lined with enameled metal.

The sleeping cars are equipped with double deck all-metal bunks. The eight bunks in the gang sleeping quarters are placed four on each side of the car with the aisle in the middle. Individual metal lockers are provided for each man in the outfit in which to keep clothes and other personal effects. The locker room also contains chairs and tables and is used as a lounging room during the leisure hours. The foreman's room is equipped with a ¾ size metal bed, desk, locker and chairs.

The refrigerator placed in each tool car is well built and large enough to hold a quarter of beef and several days' supply of other perishable foods. Shelves and closets are also built in the refrigerator room and used for the storage of canned goods and other foods. The tool and material section of this car is equipped with bins for the storage of small material, racks for the storage of tools, and a small work bench.

Under each of the dining and sleeping cars, a box is constructed for the storage of double windows during the summer months, and for the screens during the winter months, each window or screen fitting into a separate rack in this box, thus protecting it from breakage. Lockers are constructed on one side of each platform, and are used for the storage of blankets, linen and other equipment. The kitchen utensils supplied are of a substantial hotel grade. All crockery ware provided is of heavy white vitrified china. Well made mattresses, standard army blankets and enough sheets and pillow cases to permit of frequent changes are provided. All such equipment has been standardized and stocks are maintained so that prompt replacements may be made.

Field Inspection and Running Repairs

There are now 110 of these outfits in service, comprising 420 cars and having accommodations for a total of 1,760 working men. A new shop, with space for 16 cars, has been completed recently for the construction of all new outfits and the conduct of all shop repairs. Some outside work is done in the shop yard. The lost time period due to shop repairs averages about six weeks—four weeks at the shop and two weeks for the trip to the shop and return to point of service. About every 18 months, light repairs are made in the field and the cars are revarnished on the exterior and repainted on the interior, if such work is necessary.

An inspection of the outfits is made once a year by car inspectors who report in detail on the condition of the cars and decide what repairs must be made, when they shall be made, and whether the work should be done in the shop or in the field. The shop schedule and field work schedules are prepared several months in advance, the shop schedule providing for a uniform output throughout the year, and so arranged that the work on the cars is handled promptly on arrival, and the lost time period held to a minimum. Field work is done during the summer months when the weather is favorable for painting, and is handled by small gangs of men sent out from the shop. The outfits are continued in service while field work is in progress. Supervision of this work is delegated to the car inspectors. Small mechanical repairs that may be necessary from time to time in order to have the cars pass in interchange are made by the railroad companies at standard rates.

Is the Canting of Rails Desirable?

A Review of the Experiences of Typical Roads Indicates that They Have Found it Advantageous

By MILBURN MOORE

ONE OF THE problems of track design and maintenance regarding which much difference of opinion prevails is that of canting rail inward in order to provide a bearing surface more nearly coinciding with the contour of car and locomotive wheels. This question has long been the subject of active discussion and many changes in practice have been made on the railroads in respect to rail inclination. The following article outlines the developments which have taken place in this direction on 36 representative roads in the United States and Canada.

The information in this article was obtained from a questionnaire which was sent to 37 typical railroads, from which 36 replies were received. The replies to this questionnaire were, in many cases, in considerable detail. The main points have been tabulated to show quickly the roads involved, whether canting is employed and if so the period of use, how obtained, and the degree of inclination. These points and others are further elaborated to show the general trend and the results in respect to each question, following which is an abstract of the practices of each individual road. The questions which were submitted are as follows:

1. The extent to which you are canting your rail?
2. The length of time you have followed this practice?
3. The degree of inclination?
4. The manner in which it is secured?
5. Where rail is canted, have any special difficulties been encountered, and are any special provisions made through switches, etc.
6. The effect on track maintenance?
7. Other results?
8. Your conclusions regarding its merits?

Majority of Roads Answering Cant Their Rail

A study of the replies shows the interesting fact that the majority of the roads cant the rail, although the amount of the cant varies between an inclination of 1 in 20 and 1 in 40 to 44. As might be expected, there are many roads on which only a small mileage of rail is canted, because of the practice having been adopted recently and followed principally with the laying of new rail. Fully half of the roads, however, have been canting the rail as a regular practice for from 7 to 10 years, while a few have followed this procedure for as long as 20 years. There is also to be considered the fact that many of the roads had canted rail experimentally previous to its adoption as standard practice either for one class of rail or track or for all classes of rail and main track.

Of the 36 roads replying, 21 are canting rail and favor this practice, and where it has been in use for some time, report beneficial results from it. Six roads state that they have installed experimental sections of track and nine state that they are not canting rail. Of the six roads reported as experimenting with canted rail, one states that it has observed no particular advantage as yet and expresses the belief that an inclination of 1 in 20 is too great and that 1 in 44 is a more practical maximum; the remainder state that although it is yet too early to arrive at any definite conclusions the results to date indicate possible benefits and the subject is well worth further study and investigation. Of the nine roads reported as not canting, three made no statement other than the fact that this practice is not followed; four are opposed to canting or are not convinced that it is justifiable, and two state that no decision has been arrived at yet as to future tie plate standards, although the subject is now under consideration. One of these latter roads expresses a belief that there are many desirable features to canting and that an inclination of 1 in 44 is a practical maximum.

It is particularly apparent that the question of the degree of inclination or the amount of cant has developed two distinct lines of thought, with the result that practically all of the slopes in use today fall in two general classes. Of the 21 roads which have adopted canting, 11 use a slope of 1 in 20 (in one case, 1 in 24), 8 use 1 in 40 or 44, one uses 1 in 20 on the inside rail of curves of 6 deg. and over, and 1 in 40 on tangents and light curves and the ouside rail of heavy curves, and one adzes to the inclination necessary to secure a full bearing on the rail. Proponents of the 1 in 20 cant advocate and use this inclination for several reasons,

the primary ones being that this slope corresponds to the angle or coning of new or newly turned wheels, thus producing a center bearing of the wheel on the rail; that this inclination offers an adequate amount of turning in of the rail to offset the forces tending to turn the rail out, and that in actual use it has given uniform wear on the rail head, lessened or eliminated regaging of track, etc. While it is apparently generally agreed that a better center bearing would be secured on new rail with new wheels, many have felt that the wear of wheels is such that a 1 in 20 cant is not justified and that a more practical and less theoretical degree of inclination with a consequently better wear of the rail is obtained with a cant of approximately 1 in 40 or 44.

The required inclination of the rail, whether 1 in 20 or 1 in 40 or 44, is obtained in practically all cases by the use of inclined tie-plates. The principal variations from this are the practices of the Delaware, Lackawana & Western, the Chicago, Milwaukee & St. Paul, and the Norfolk & Western. On the first named road, all ties are adzed at the treating plant to a 1 in 40 cant, and flat tie plates are used. The St. Paul adzes its ties to whatever slope is necessary to secure a full bearing on the rail. The Norfolk & Western uses canted plates under all new rail laid on its lines with the exception of tangents where 100-lb. rail is still being used without tie-plates. On such tangents the ties are adzed to give an approximate of 1 in 20 to the rail.

No Difficulties with Canted Rail at Switches and Frogs

The use of canted rail in European countries considerably antedates its use in this country and the practice was carried out in all its details to what might be termed a complete exactitude. In other words, the switches and frogs were designed either to carry the same inclination throughout, or special provisions were made in the fastening to change from the vertical to the inclined without causing any twist or torsional strain in the rail. When the announcement was made about about four years ago that the French railways were going to the vertical rail, one of the main points cited was this question of connecting the running rails with switches and frogs. Contrary to the European practice, the American roads have never resorted to the use of canted switches and frogs or of special fastenings of any nature. Many roads which are not canting rail, feel that the joining up of canted running rails with vertical appliances such as frogs and switch points, introduces a torsional strain in the rail that is not to be desired. It is therefore interesting to observe that only 1 of the 21 roads reported as canting rail, states that any difficulties arose from this reason, and then only of a minor nature in several locations. Many of the roads make no provision whatever for changing from the canted rail to the vertical, using canted tie plates up to the frog or switch point and under the lead rails through the turnout, the change in inclination furnishing no difficulty in connecting up or in securing a satisfactory bearing after a few trains have passed over the track. Other roads, however, have made provisions to bring about the change in inclination more gradually. This is usually done by adzing the ties slightly for about one rail length at either end of a turnout or crossing frog. In such installations, flat tie plates are used through the full length of the turnout. Only one road, the Erie, has apparently attempted the use of canted rail through switches, and this only in a few cases where the canting was carried through the switches as much as possible, by removing the slide plates and adzing the switch timbers accordingly. The general opinion of the roads which are canting rail, as manifested by the answers, is that either plan of procedure gives no trouble, needs no particular attention and elminates what would otherwise be an expensive refinement.

Results from Canted Rail

The answers to questions 6, 7 and 8 were largely combined and show a surprising uniformity on the part of the roads which are canting their rail. Practically all agree that the rail receives a better bearing on the head, more even wear and greater life. Another result equally well stressed was that canted rail holds to gage much better than vertical rail in the same locations and that this was particularly evident on curves. Others mentioned that flange wear on wheels is decreased, the coefficient of adhesion of engine drivers was increased and better track obtained more easily. It was pointed out that the use of an inclined plate permitted a thicker plate at the point where a plate nominally undergoes the greatest strain, and that this could be secured with no increase in weight. The breakage of plates is reduced and there is less cutting-in or mechanical wear of the ties where canted rail is used. The lessened amount of regaging (obviated entirely on the Lehigh Valley, for instance), the longer life of the rail and fastenings, the decreased mechanical wear of the ties, result in a decreased amount of labor for maintenance work. While this amount is difficult to estimate, it represents a saving in mainteance costs, which is thus attributed to the use of canted rail.

While the question relative to conclusions regarding the merits of canting was largely answered in conjunction with questions 6 and 7 and from the viewpoint of the results obtained, a number of roads stated their conclusions in a slightly different form. Thus there are found statements along the following lines:

"We are firmly convinced that the canting of rails is a move in the right direction."—Boston & Albany.

"We believe that the benefits obtained in rail of high section warrant the practice of canting."—Chesapeake & Ohio.

"We would not consider any other practice than the one which we now have, through the long years of practical experience, demonstrated to be the practice of wisdom."—Chicago & Alton.

"All of our division engineers report very favorably on the use of canted tie plates."—Erie.

".....think well of canting and the practice is being extended on our line."—Great Northern.

"There is evidently considerable merit in having rail inclined and it is possible that more of this will be done in the future."—Illinois Central.

"Our final conclusions from over eight years' experience are, that it is essential for efficient and economical maintenance to cant the rail in and that the proportion of 1 to 20 is just about right."—Lehigh Valley.

"My conclusions as to rail inclination were reached some time ago and I see no reason to change my opinion, that it is the proper thing to do."—Richmond, Fredericksburg & Potomac.

".....now that we have actually laid considerable rail with canted tie plates, we are more than pleased with results."—Southern Pacific Company (Pacific System).

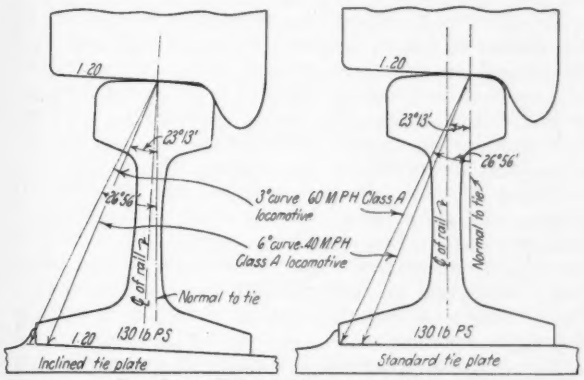
".....a canted tie plate is well worth while on all new main track construction, both tangents and curves."—Union Pacific.

Pennsylvania Opposes Canting

The advantages derived from canted rail as given in the preceding part of this article, as well as the views enumerated above, are not shared by a number of roads that are not following this practice. In order that the negative side of the question may be better shown, the views of two roads, the Pennsylvania and the Rock Island, are given here in part. The views of the first road are contained in replies to a summary of the chief points in favor of canting rail.

Point 1. An appreciable lengthening of the life of

ties is accomplished by canting the rail so as to bring the bearing of the wheel as nearly as practicable in the center of the rail head, as it is clear that the tendency for rails to cut into the tie, requiring an additional amount of adzing, is avoided. Comment: The reasoning in this answer is unsound, because the avoidance of cutting of tie plate into the tie is brought about by using one of suitable size and properly proportioned inside and outside of the rail without any regard to the question of canting. Such avoidance has been brought about on the Pennsylvania System with flat plates many times by the use of a suitable size and properly proportioned plate, combined with adequate maintenance. In fact, the tendency to cut into the tie at the outer edge of the tie plates is promoted by canting the rail instead of diminishing it, as shown by the diagrams illustrating



Resultant Wheel Thrusts on Curves

the lines of resultant force produced by a heavy locomotive when passing around curves of three and six degrees respectively. These lines were determined by a study of the locomotive tests on the Atlantic division to determine outward pressure, when rounding curves, of the new designs of electric locomotives and by mathematical development. Attention is called to a part of the problem which has not usually been mentioned—the theoretical advantage of the axial center bearing on the rail head by canting the rail is realized only when the rolling stock is standing still with new wheels on new rails or when running without side lurching. The latter is a very rare condition, as there is nearly always a side thrust on the rail, even on tangent, and in the case with our lines with a large percentage of curvature, the side thrust is very important. The vertical load and side thrust produce a resultant pressure which falls far outside of the center of the vertical axis of the rail, and with a center bearing on the rail this position of the resultant pressure is at a greater distance from the center than when there is a bearing between the center and the gage of the rail head. What is gained by a center bearing with the inclined rail is largely lost by the additional distance of the line of resultant pressure from the center. Instead, therefore, of the value of canting being greater on curves, as against the tendency to cut ties, the condition for cutting is aggravated.

Point 2. The wear on the head of the rail will be more symmetrical and probably the life of the rail will be lengthened, especially on curves, by centering the wheel bearing as nearly as practicable on the rail head. Comment: With worn wheels and rail heads, which is the prevailing state of affairs, the advantages which might arise from a center bearing on the rail head are theoretical and indefinite. In some cases where the wear on the rail head has been very uneven, the cause has been poor maintenance with an improperly proportioned tie plate on the low rail of a curve, which must bear more than its share of the weight of a slowly moving freight train around a curve which is superelevated for the higher speed passenger traffic. With all of these years of experience with upright rail we know very well that for the most part the wear on the head is quite symmetrical and even. Rail may be found in the track with any degree of uneven wear on any kind of a tie plate, according to the lack of proper maintenance.

Point 3. Canting of the rail counteracts to some extent the side pressure of the wheels, especially in running around curves, and also the side blows on tangents caused by the nosing of engines. Comment: This is unsound reasoning, already commented upon in point one. The claim that canting of the rail reduces the wear on the outer rail of curves very materially, which would follow from this, has not been substantiated by tests we have conducted. Rail wear and pressure on the outside rail are due to the flange of the locomotive wheels changing the direction from a tangent around the curve, and certainly are not affected by inclination. The two subjects do not belong together.

Point 4. Canting will remove some of the stresses in the rail by the wheel riding over the web in place of one side, suggesting the conclusion also that transverse fissures may be due to the eccentric bearing on the side of the head, which would be hindered by the canting. Comment: Transverse fissures are not caused by the traffic borne by the rails, but by defects in some of the processes of manufacture. They are developed in service by the wheel loads, and the heavier the wheel loads and the greater the tonnage of traffic, the more rapid the development in all probability.

Point 5. Rail with inclined tie plates holds the gage better. Comment: This is a fallacy, as already explained in point one, as the gage can be held securely and properly by an adequate number of spike fastenings. In fact, the experience of the French railroad systems discloses the fact that, especially on tangent lines, there is a tendency to excessively tight gage with inclined tie plates.

Point 6. There is less cost in maintenance. Comment: No information of record has been furnished to support this statement with proof.

Point 7. By having the center bearing it is thought that there is less battering of rail joints. Comment: No evidence of this has ever been collected, but it is not believed that the inclination of the rail has any appreciable effect in reducing battering, which is more likely to be the cause of poor maintenance combined with weak joints.

Point 8. Inclining the rail does not increase the friction of moving loads. Comment: This is a negative advantage, as it is not understood that rail laid vertically does that either.

Point 9. The universal desire of those favoring rail inclination is that such inclination should not be carried through turnouts on account of requiring considerable expense in the construction of special devices without justifiable results. The claim is made that the change from the canted to the vertical position is so slight and so easily accomplished that careful observation must be made to determine where such changes occur. It is stated that this change has been made on curves on the Cincinnati division, where one-half of the curve was laid with canted tie plates and the other half with the flat tie plates. Comment: This looks like a

rough and unbusinesslike way of dealing with the problem, and it is only in the United States and Canada that such looseness in construction has been practiced. In England and Europe, where the practice originated, it has been the custom to carry the inclination through the turnouts.

Point 10. As the top inclined surface helps the kicking out of the tie plate by wedge action, the shape of the bottom of the plate deserves attention, and the belief is expressed that a multiplicity of spike holes in the tie from the use of anchor spikes is more destructive and lessens the life of the tie much more than the use of a tie plate with properly designed corrugations on its base. Comment: The best answer to this is the satisfactory result of the use of such well spiked tie plates for many years on that portion of the system west of Pittsburgh, and the fact that although the original design of tie plate had ribs for engaging in the tie it has long been recognized by railroads that such a tie plate was objectionable and the use of that style has been on the decrease.

Rock Island Sees No Advantage in this Practice

The following represents the views of the Rock Island on this question:

When using a canted tie plate a strain is put into the canted rail when it joins a frog or a crossing, and there are also difficulties in connection with its use through switches. The principle of trying to bring the center of the load onto the center of the rail is attractive, but with a properly constructed tie plate which holds the rail to gage, no apparent weakness is developed in the rail, due to the fact that the theoretical bearing comes about 5/8 in. from the center of the rail. Also the wear of the wheels is such that the theoretical canting in the tread of the wheel only remains on the wheel a few days, or a few weeks at the outside, after the wheel is put into service, or, in the case of a driver, after the driver is freshly turned.

If any one will go into a railroad yard and take contours of 100 cars, hit or miss, he will find that 75 per cent of them have either a flat or a concave tread, so that, in fact, the bearing of 75 per cent of the wheels that pass over the rail is over the center of the rail. The canted tie plate is a very pretty theory, but it amounts to little or nothing in practice. It was evidently the result of the old practice, in the days of light rail and before the introduction of the tie plate, of the track man's canting in of the rail in an effort to prevent the movement of the rail outward and the resulting widening of the gage. He had no thought of bringing the load onto the center of the rail, but was only trying to hold his track to gage. The introduction of the modern type of tie plate has done away with the necessity for canting the rail for that purpose.

More Details on the Practices of Individual Roads

Because of the differences of opinions and practices in respect to the canting of rail, the individual practices and opinions of the various roads are of interest and for that reason are given as follows:

It has not been the practice of the Atchison, Topeka & Santa Fe to cant rail for over 19 years. About 1904 a small amount was installed with tie plates canted 1 in 55. In 1923 a small number of canted tie plates were installed on second track as a test.

In 1921 the Baltimore & Ohio adopted 130-lb. rail as standard for certain parts of its system, using with this, canted tie plates measuring 7 in. by 11 in. by 3/4 in. thick at the shoulder and inclined 1 in 20. On this road it has been very noticeable that the line of rail wear where canted plates are used, is almost perpendicular to the vertical axis of the rail and throughout the life of the rail. The gaging necessary has been less than where flat plates are used, which means a marked saving in ties, as well as in labor cost for regaging and adzing. In certain locations, this road experienced some difficulty at the switches, where canted tie plates were used, up to the flat switch plates. To overcome this difficulty, flat tie plates are now used through the turnout and for at least one rail length on either side. It is believed that the use of canted tie plates, canting the rail to the approximate angle of the wheel tread, is more economical in the use of materials and labor, than laying rail on flat plates.

The Atlantic Coast does not believe that the canting of the rail is justified, although developments are being watched closely.

The Boston & Albany has practically completed the installation of canted tie plates under all rail in its main tracks and on curves on branch lines. An inclination of 1 to 44 is used and the practice has been followed for seven or eight years. The road has found a very large reduction in the expense of rolling in the rail as well as a large reduction in the cutting of ties, and the widening of gage, although this has not been entirely eliminated. It has secured better wear on the rail head and some reduction in flange wear. No difficulties have been encountered with switches, the canted plates being used right up to the switch plates. This road is firmly convinced that the canting of rails is a move in the right direction.

The Canadian National is canting its rail at the rate of about 125 miles per year, using canted tie plates with a slope of 1 in 20. The practice of canting rail has been followed for about five years and has eliminated the work of rolling in rails rolled out in service, and thus the adzing of ties to level the rail seat. Less wear has also been found on the gage side of the head of the rail. It is believed that the result of transferring the wear on the head of the rail to the center of the head, will reduce the amount of wear materially, as well as lessening the liability of fracture. No serious difficulty has been encountered in taking care of the canting of rail due to the 1 in 20 slope of the plate, a little attention when gaging the track adjacent to frogs and crossings, all of which lie level on the ties, overcoming any trouble.

The Canadian Pacific adopted canted tie plates with an inclination of 1 in 20 and a cambered base in 1914, following a number of years of experimental use of canted rail. No special provisions are made through frogs and switches and no difficulties have been encountered. The results which have been obtained, such as, more uniform wear of the rail and less regaging of track, have been satisfactory and the road is not considering any change from this practice.

The Chesapeake & Ohio started canting rail in a small way about seven years ago and has gradually increased the practice. It is now using canted tie plates with a 1 in 20 slope, on all 130-lb. rail, which constitutes about 30 per cent of the rail renewals. No special provisions have been made through switches. This road has found that canting the rail saves labor in gaging and lining, reduces curve wear, causes more equal distribution of wear, increases the life of the rail and produces smoother riding track by reducing lateral motion. It is believed that the benefits obtained in rail of high section warrants the practice of canting, although it is not felt positively that 1 in 20 is the proper slope but rather that equally satisfactory results could probably

be obtained with a flatter slope. While equally good results could be obtained by the use of inclined tie plates on sections of 100 lb. or less, this road has such a large installation of flat plates on rail of this section that it has continued the use of flat plates for this class of rail.

The Chicago & Alton lays all new rail on canted tie plates, the inclination being ⅛ in. from the horizontal in the width of the base of rail (100 lb. A.R.A.), or approximately 1 in 44. This has been the uniform practice of the railroad for 12 years and to a lesser extent previous to that. No difficulties have been encountered at switches and no special provisions have been made. This road feels that the theory of the canted rail is technically correct in that the surface of the rail conforms to the coning of the car wheel. The use of canted rail greatly increases the coefficient of adhesion and augments the tractive effort of the engine, and it furnishes smoother riding track. The effect on track maintenance is evident in the increased life of the rail, decreased wear of wheels, a decreased tendency to the backing of track spikes, a lessened amount of work for regaging and a decreased liability for accidents resulting from broken flanges and rails. This road would not consider any other practice than it is now following in respect to canting.

The Chicago & North Western has made a number of experimental installations of canted rail, using tie plates inclined to a slope of 1 to 20. These installations are of such recent date that no data of particular value are yet available. It is believed that the general practice of using canted tie plates would not be justified at this time for the reason that during the past few years, flat tie plates have been installed in connection with tie renewals. It would, of course, be unwise to mix the flat and canted plates and the road could not afford to discard the flat plates now in service. It is believed that the only justification for the elimination of the flat plates might be on very sharp curves where the rail wear is excessive.

The Cleveland, Cincinnati, Chicago & St. Louis has about four miles of track on which canted rail is in service experimentally. About one-half has been in service about three years and the rest about one year. Canted tie plates with a slope of 1 in 20 are used. So far the road has been unable to detect any results which indicate an advantage in the canting of rail as regards track maintenance. The results tend toward the belief that a cant of 1 in 20 is too great and that it should not be more than 1 in 44. No special difficulties have been encountered and no special provisions have been made through switches.

The Chicago, Burlington & Quincy has always used canted rail to some extent, the ties being adzed before the general use of tie plates was begun about 15 years ago. Canting is obtained with an inclined plate having a slope of 1 in 40. No special difficulties have been encountered at switches and no special provisions are made. As a general conclusion, it is believed that the canting of the rail has overcome the problem of wide gage due to the rolling of the rail and, as a result, has naturally brought about some economy in maintenance.

All rail that is laid for renewals and all rail that is regaged on the Chicago, Milwaukee & St. Paul is canted sufficiently to give the wheels a full bearing on the head of the rail. This is generally done by adzing. From 1905 to 1910 the St. Paul bought canted tie plates, but it discontinued the practice in the latter year. No particular difficulty was experienced with the canting of the rail except when it was done with tie plates. Rail is never canted through switches. It was found that canting the rail reduced the rail wear and also the amount of labor required to hold track to gage. It has also helped to avoid derailments on extremely sharp curves. The thought that all rail has a tendency to roll out and unless it turns out uniformly, torsional strains are set up in it was the principal reason for discontinuing the use of an inclined tie plate. This road also found it impractical to tie plate the track out of face and likewise to provide a sufficient supply of inclined plates to replace the broken ones, and the use of a few canted plates with plain plates on either side, or the absence of plates made a very unsatisfactory rail condition.

All ties that are used in the tracks of the Delaware, Lackawanna & Western are adzed at its treating plant to a 1 in 40 cant and installed with flat tie plates. This practice has been followed for 10 years and the results have been entirely satisfactory. This road believes that it is necessary to cant the rail, but that care should be exercised in all locations where canted rail meets vertical rail, such as at switches, etc. Some means or methods should be devised to adjust properly the difference between the two positions. With a cant of 1 in 40, this has not affected the Lackawanna to any great extent, but where it is necessary the adjustment is made by adzing.

The Erie commenced the use of canted tie plates in 1922, using a slope of 1 in 40, so that its experience thus far is limited. It is stated, however, that all of the division engineers have reported very favorably on the practice. It is believed that the canting of the rail will prevent the widening of the gage and secure a longer life for the rail, thus producing economies in labor and materials. The plates are 7 in. by 10 in., 2¾ in. outside the rail and 1¾ in. inside, with a camber of 1-16 in. They are used with 100-lb. A.R.A. type A rail. No special provisions are made through switches, the 1 in 40 inclination taking ample care of the situation without adzing, although in some cases the canting is carried through the switches as much as possible by removing the slide plates and adzing the switch timbers accordingly.

The Great Northern cants the rail wherever the track is tie plated and on the inside of sharp curves where it is not tie plated. The canting is secured by tie plates where tie plates are used, and by adzing where they are not used. Inclined plates have been in use for about 17 years and the canting of the inside rail of curves has been followed for 30 years or more. On tangents, light curves and the outside rail of heavy curves, an inclination of 1 in 40 is used, and for the inside rail of curves of 6 deg. and over, 1 in 20. No special difficulties have been encountered and no special provisions are made through switches. It has been found that the canting of rail adds to the life of the tie by decreasing the tendency of the rails to spread, and also adds to the life of the rail by producing a uniform wear on the rail head. The canting introduces some troubles where base plate joints are used and adds to the difficulty of adjusting the track within the limits of turnouts, crossings, etc., but such difficulty does not constitute a serious objection to the practice. This road thinks well of canting and the practice is being extended.

The Illinois Central has only made a number of short experimental installations of canted rail, using an inclined plate with a 1 to 20 slope. The service rendered shows some advantage in that it is not necessary to gage track as often as formerly. The wear on the rail is also decreased. It is believed that there is considerable merit in inclining the rail. The practice has been retarded somewhat because of the necessity of install-

ing canted tie plates out of face. Inclined plates are being used on a new line in Kentucky which is now under construction.

The Lehigh Valley has been canting its rail since 1916 and all 136-lb. rail or approximately 542 miles is so laid. Canting is secured by the use of a plate inclined to a 1 in 20 slope, 8 in. by 11½ in. by ¾ in. thick at the shoulder, extending 3 in. outside the rail and 2 in. inside. These plates are used under all rails except switch rails, and although some concern was felt about the switches when the use of inclined plates was started, no trouble has been encountered in securing and maintaining a proper fit. The greatest benefit from canted rail is the reduction of maintenance and the prolonged life of the tie plates. It has been found that the rail stays as laid and does not roll in or out. The Lehigh Valley never re-adzes or re-gages the track. When the rails are worn to the economical point for transposing, they are changed from one side to the other, the resulting effect being to restore to normal the gage which had previously been widened slightly by wear. There is some gain through canting by decreasing the rate of wear of the head of the rails. This road has retained the lengthened end of the tie plate outside the rail since it was found that the inclination of 1 in 20 is not sufficent to counteract entirely the tendency of the rail to roll out. The conclusions of this road after 8 years' experience are that canting is essential for efficient and economical maintenance and that the proportion of 1 in 20 is about right.

All rail on the main line of the Michigan Central is canted, inclined plates with a slope of 1 in 20 being used. This practice has been followed since 1915. The rail is canted practically up to the switches and frogs and no difficulties have occurred in making the change from a 1 in 20 inclination to vertical. The opinion of this road is that the canting of rail is good practice and will ultimately result in more uniform wear of the head of the rail, less flange wear, less necessity for re-gaging and a decreased tendency for the rail to roll out.

The Missouri Pacific has issued no definite instructions concerning the canting of rail but the practice has been followed to a limited extent on certain portions of the line, particularly on heavy traffic main lines where there is considerable curvature. It is still regarded as in the experimental stage and where inclined plates are used, the slope is 1 in 20. Where adzing is done the slope varies from 1 in 20 to 1 in 30. No switches have been involved in the installations of canted rail. The opinion of those who have had experience with canted rail on this line is that it requires less adzing in and therefore results in less damage to the ties and that the cost of maintaining proper gage is reduced considerably. Although definite studies have not yet been concluded to verify this opinion. The canted rail also seems to show less wear on the head. It is believed that the practice is worthy of further test and study.

The New York Central as well as the New York Central Lines have not as yet reached any conclusion in regard to a standard tie plate. The subject is still under observation and development.

On the Nashville, Chattanooga & St. Louis, the rails are canted where the latest standard tie plates are installed, using an inclination of 1 in 40, which is obtained with canted plates. The amount of track covered by these plates is estimated at about 140 miles. The practice has been followed about three years. No difficulties have been experienced at switches and frogs and no provisions have been made for adjusting the difference in inclination. While no definite data are available to show how much the life of the rail is increased, it is believed that there will be a considerable increase on account of canting. Canted rail also offers added resistance to the turning out of rails.

It has been the standard practice of the New York, New Haven & Hartford to cant rails where new tie plates are being installed since 1920, using a plate with a slope of 1 in 20. No special provisions are made through switches and frogs and no difficulties have been experienced. It is believed that canting reduces the cost of track maintenance. The principal benefits secured from canted rail are greater ability to hold gage, better wear on the rail head, and some saving in metal when using an inclined plate, as the greatest thickness of the metal is at the point where the plates are most likely to bend.

Tabulated Statement of Canting Practice

Road	Is Rail Canted?	How Long	Amt. of Slope	How Secured
A.T.&S.F.	Exp.	Since 1923	Not given	Inclined Plates
A.C.L.	No	.....	.....	.....
B.&O.	Yes	Since 1921	1 to 20	Inclined Plates
B.&A.	Yes	7 or 8 years	1 to 44	Inclined Plates
B.&M.	No	.....	.....	.....
C.N.R.	Yes	About 5 yrs.	1 to 20	Inclined Plates
C.P.R.	Yes	About 10 yrs.	1 to 20	Inclined Plates
C.&O.	Yes	About 7 yrs.	1 to 20	Inclined Plates
C.&A.	Yes	12 yrs. or more	1 to 44	Inclined Plates
C.&E.I.	No	.....	.....	.....
C.&N.W.	Exp.	3 years	1 to 20	Inclined Plates
C.B.&Q.	Yes	15 yrs. or more	1 to 40	Inclined Plates
C.M.&St.P.	Yes	Since 1905	Not given	Adzing Since 1910
C.R.I.&P.	No	.....	.....	.....
C.C.C.&St.L.	Exp.	About 4 yrs.	1 to 20	Inclined Plates
D.L.&W.	Yes	10 yrs.	1 to 40	Adzed with Machine
Erie	Yes	Since 1922	1 to 40	Inclined Plates
G.N.	Yes	17 yrs. or more	1 to 40 and 1 to 20	Both Plates and Adzing
I.C.	Exp.	3 years	1 to 20	Inclined Plates
L.V.	Yes	About 8 yrs.	1 to 20	Inclined Plates
L.&N.	No	.....	.....	.....
M.C.	Yes	About 9 yrs.	1 to 20	Inclined Plates
M.P.	Yes	Not Given	1 to 20 and 1 to 20 or 30	Both Plates and Adzing
N.C.&St.L.	Yes	About 3 yrs.	1 to 40	Inclined Plates
N.Y.C.	No	.....	.....	.....
N.Y.N.H.&H.	Yes	About 4 yrs.	1 to 20	Inclined Plates
N.&W.	Yes	Since 1909	1 to 20	Both Plates and Adzing
N.P.	Yes	Two years	1 to 20 or 24	Inclined Plates
P.R.R.	No	.....	.....	.....
P.&L.E.	No	.....	.....	.....
Reading	Exp.	One year	1 to 20	Inclined Plates
R.F.&P.	Yes	About 5 yrs.	1 to 20	Inclined Plates
S.A.L.	No	.....	.....	.....
S.P. Tex.&La S.P.	Yes	First year	1 to 44	Inclined Plates
Pac.System	Yes	One year	1 to 44	Inclined Plates
U.P.	Exp.	3 years	1 to 20	Inclined Plates

Rail being laid on the Norfolk & Western at this time are fully equipped with inclined tie plates, canting the rail to a 1 in 20 slope, except on tangents where 100-lb. rail is used without tie plates. On such tangents, the ties are adzed to cant the rail to a slope as nearly 1 in 20 as possible. During 1909 a test was made on several curves, canting the rail sufficiently to secure a full bearing on the head of the rail. This was done by adzing, as flat tie plates were then in use. After making these tests, it was found that the life of the rail was increased and in the following years when new rail was laid, it was canted inward by adzing. This practice was continued until 1920 when a tie plate with a 1 in 20 slope was adopted. No trouble, so far as it is known, has been encountered in connection with the use of canted rail at switches, etc. The experience of this road has been that the life of the rail is increased through the use of rail with an inclination of 1 in 20 as the rail is worn more uniformly and corrugations do not set in on the head of the rail along the gage nearly so badly as they do with vertical rail. The cost of maintaining the gage has been reduced and a saving in

the general upkeep of the track has also been effected.

The Northern Pacific is using canted rail to a limited extent on main line relaying work. About three per cent of the main track mileage is now laid on canted plates. This practice has been followed for about ten years. The inclination is 1 in 20 on 7½-in. by 10½-in. plates. For 130-lb. rail, which is used on sharp curves, an 8-in. by 12-in. by 13-16-in. tie plate was designed with a slope of 1 in 20. A limitation of at least 9-16 in. at the inside edge of the rail base resulted in producing an inclination of 1 in 24, which is the cant used with the 130-lb. rail. Flat plates are used through turnouts, etc. While the experience of this road with canted rail is limited, it is felt that this practice will result in more uniform rail wear and that there will be less outward inclination of rail on curves and a consequent decrease in the amount of re-gaging which is destructive to ties. It is believed that the canting of rail is desirable on curves, but for the reason that this influence is overshadowed by other considerations, it may not be possible to obtain a definite confirmation of this through a segregation of the actual maintenance savings for some time. This is primarily because the canted tie plate is larger than the previous flat plates and the substitution of 130-lb. rail for 90-lb. rail will bring about other savings, which will make it difficult to place values upon the canting alone. The use of canted plates is still experimental with the standard main line rail section but the canted plate has been made standard for the 130-lb. section for curve use.

The Pittsburgh & Lake Erie is not canting its rail. This road uses treated ties, mechanically adzed and bored, a condition which makes it difficult to change the design of tie plate as the base of the rail cannot be moved out without changing the holes bored in the adzed bearing surface, and thus damaging the ties. No objections are seen to canting and it is felt that there are some arguments in its favor. It is believed that an inclination not exceeding 1 in 40 is desirable. The main benefit to be derived from canting will be to bring into play the entire head of the rail, thereby reducing the intensity of pressure at the point of contact between the wheel and the rail by increasing the area in contact.

The Reading has, as yet, canted rail only experimentally and for about one year. Approximately 15,000 inclined tie plates with a slope of 1 in 20 have been installed on a heavy traffic line carrying both freight and passengers. Although it is too early to determine the probable effect on track maintenance, the road is securing better wear on the head of the rail than formerly. No difficulties have been encountered through turnouts and crossovers except in the case of the guard rail which remained vertical as opposed to the canted main rail. This made the guard rail appear out of line and gave an uneven appearance which was corrected by adzing slightly under its rear edge to give it approximately the same inclination as the main rail. It is believed by this road that the subject of rail canting is worthy of further consideration.

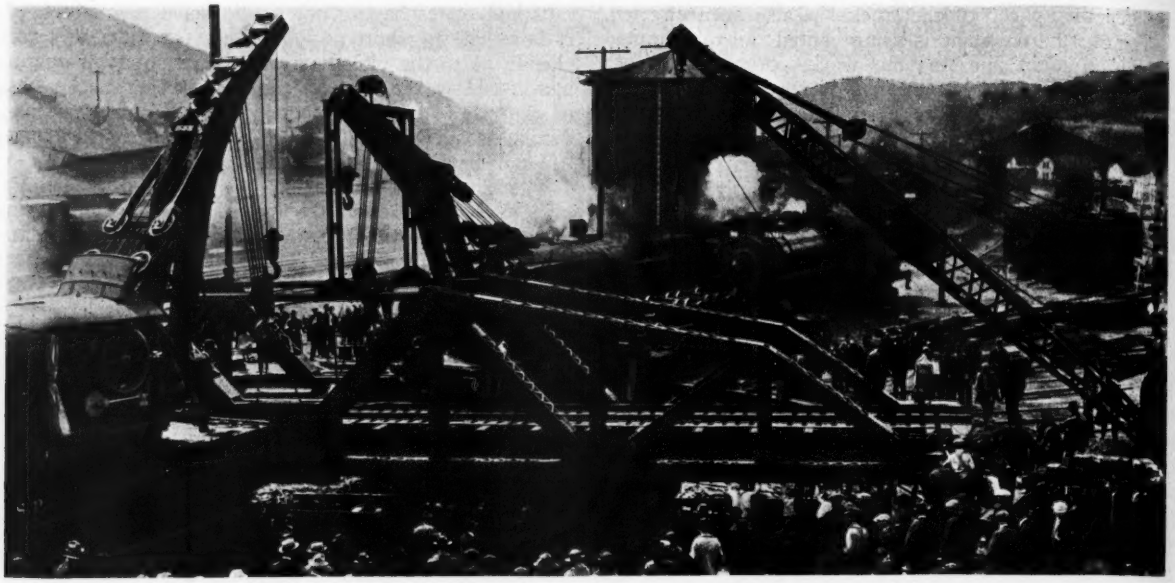
The Richmond, Fredericksburg & Potomac started canting rail in 1920 and has followed the practice whenever rail renewals were necessary since that time. About 28,500 tons of 100-lb. section have been laid this way, using an inclined tie plate with a slope of 1 in 20. The practice of the road at turnouts, etc., is to run off the inclination before reaching the switch point, carrying the rails on flat tie plates through the switch lead and returning to the inclined plates beyond the heel of the frog. In the four years' experience of this road, no trouble has been encountered at switches, the rails and plates having quickly adjusted themselves. It is felt that the short period of use precludes any conclusion as to the effect of canted rail on track maintenance. However, the difference in wear on the head of the rail where it is inclined and where it is perpendicular is very marked and it is believed that a greater life will be secured from canted rail.

The Texas and Louisiana lines of the Southern Pacific have inaugurated the use of canted rail, laying about 100 miles of 90-lb. rail this year on inclined plates with a slope of 1 in 44. These inclined plates have been adopted as standard and will be used on all new work and on rail renewals. No special difficulties have been encountered at frogs and switches. The inclination is gradually tapered off for about a rail length in advance of and behind turnouts by adzing the ties slightly to overcome the tie plate bevel. It is expected to secure a more uniform loading of the rail section and less trouble from widening gage.

The Pacific system of the Southern Pacific adopted 110-lb. rail as standard and in connection with this section adopted a 9½-in. by 10½-in. inclined plate with a slope of 1 in 44 after studying the problem from both a theoretical and a practical viewpoint. No difficulty was experienced in laying this rail or in connecting it up with the frogs and switches, the rail adapting itself readily to the slight twist caused by the 1 in 44 inclination and the vertical frogs and switches. Many years ago this company installed a tie plate with a slope of 1 in 64 on sections on various parts of the road. After a lapse of many years it was developed by numerous inspections that these beveled tie plates had undoubtedly caused the rail to remain in a vertical position. The tie plates had settled uniformly into the ties, there was no canting outward, and the general opinion of the foremen was that the track had maintained its gage and alinement better than with the flat plates. This road believes that the beveled tie plate is a forward step in track construction and that it will assist materially in securing good maintenance. The results which have been obtained with the new rail laid on a slope of 1 in 44 have been more than pleasing. It is felt that the slope of 1 in 44 is a practical maximum cant.

The Union Pacific has two experimental installations of canted tie plates with a slope of 1 in 20, which have been in service about three years and which are giving satisfactory results. The canting of rail by adzing on curves has been done for the past 10 years, but it is felt that the adzing of treated ties is a bad practice and it is recommended that canted tie plates be applied to new construction. Care should be taken in applying canted plates on adzed track for the reason that unless the bearing is level, the inclination will be exaggerated. The real value of the plates is only obtained through their application on new track where the ties have not been adzed. While no switches have been involved in the test sections, it is felt that the rail should be straightened up through the turnouts. The straightening process can be graduated by adzing the ties for a rail length on either side, if the adzing of treated ties is not objectionable. From a theoretical standpoint, if adzing is to be avoided, it would probably be necessary to provide a series of easer plates by which the cant could be graduated from zero to the full inclination in probably one rail length.

Other roads which are not mentioned in the preceding and which are not canting rail are the Boston & Maine, the Chicago & Eastern Illinois, the Louisville & Nashville and the Seaboard Air Line.



Two Locomotive Cranes Lowered the New Table on the Center

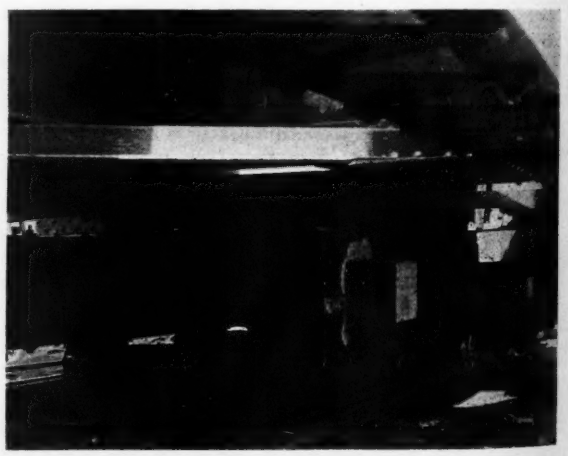
Southern Pacific Renews Turntable in Record Time

Railway Organization Replaces 70-ft. Structure with 100-ft. Span in One Hour and Forty-six Minutes

WHAT IS probably the fastest record in turntable replacement ever attained was made by the Southern Pacific at Roseburg, Ore., on April 15, when an old 35-ton, 70-ft. deck girder turntable was taken out and a new 90-ton, 100-ft. half-through truss table inserted in its place in 1 hr. and 46 min. By a proper timing of the period during which there was no access to the roundhouse, delays to traffic and to the turning of engines were entirely avoided. A record nearly as good as this, namely, 2 hr. 1 min. was made in the renewal of a turntable at the Mission Bay (San Francisco) roundhouse of this road a few months later.

Work preliminary to the actual placement of the new table at Roseburg consisted of enlarging the 70-ft. pit to the 100-ft. diameter, cribbing the tracks to permit continuous use of the old table and the building of a new concrete circle wall on cedar piles in segments with V-shaped expansion joints. One segment of the wall was left open to permit the shifting in of the new turntable, which was built on a carriage alongside of the pit. The foundation pier of the old table was enlarged with a concrete jacket having a 12-in. by 12-in. steel plate set flush with the surface near each corner. A new pre-cast concrete center cap was built in order to provide sufficient bearing for the increased load of the new table. This cap was also built alongside of the turntable so as not to interfere with the operation of the old table previous to actual replacement. Extreme care was exercised in securing the exact dimensions for this block so as to obtain the correct height when it was attached to the center casting with through bolts. Holes were provided in the cap through which to force grout after it had been placed on the pier.

Eye-bolts were provided at each corner to facilitate handling and 8-in. by 8-in. cast iron nuts tapped to receive 2-in. bolts were cast in the bottom at each corner so as to center over the 12-in. by 12-in. plates set in the top of the pier. The object of these will be explained later. In addition, two portable frame trestles about 25 ft. long were built and assembled complete with ties and rails to facilitate quick handling with



The New Table Was Balanced over a Four-Axle Carriage

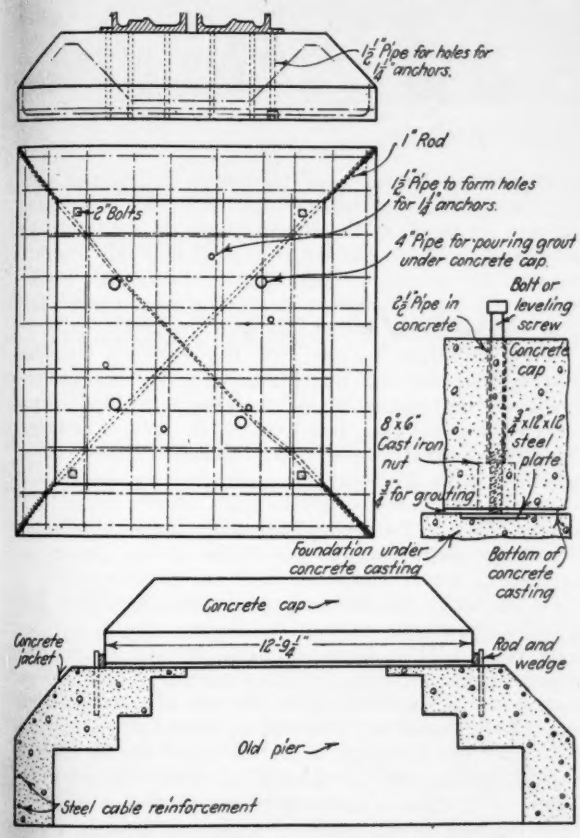
hoisting equipment. These were also erected next to the pit.

The new 100-ft. turntable was erected on a four-axle carriage which rested on a skidway, consisting of four well greased rails supported on cribbing. This skidway had only been built to the edge of the 70-ft. pit but plenty of material was provided at hand to extend it to

the center as soon as the old table had been removed.

After the last engine had been turned on the old table a locomotive crane was placed on a radial track alongside of the new table in its position on the skids. The old table was then turned in line with the new table. Two derrick cranes were stationed at the edge of the pit, opposite each other and at right angles to the old table. With this setting actual replacement work commenced.

The two cranes picked up the two temporary trestles and placed them in the pit in line with the radial tracks so that the rails could be connected and moved forward to reach over the center of the turntable. During this time the old table anchor bolts were cut with acetylene torches. One crane picked up the table and swung it clear, while the other crane picked up the old center



Alterations and Additions to the Center Pier

which had been previously drilled and chained so as to lift easily. While the old table and center were being swung clear, crews in the pit cleaned out the accumulation of debris and water and cut down any uneven spots on the surface of the center pier with jack hammer drills. This completed, one of the cranes swung the new concrete cap into the pit where it was set on cribbing.

The crane then lifted the cap with the aid of the eyebolts in the corners a sufficient amount to remove the cribbing and place it on the pier. But as the bolts or leveling screws had been screwed into the four 8-in. by 8-in. nuts a sufficient amount to project below the bottom of the caps to bear on the four steel plates set in the foundation pier for that purpose, the cap was supported clear of the base by ¾ in. This space was filled with grout prepared wet but was not in a liquid state, which was forced under the cap by means of pumps through the holes provided in the block for that purpose. The leveling screws were gradually backed off to insure uniform settlement after the grout had been placed. The position of the cap was held laterally by two dowels and wedges set at each corner and was then set to exact grade and center as given by an engineer's transit and a level.

Lifting out the Old Center

While the cap was being set, part of the crew extended the skidway from the new table to the center of the pit and removed the old radial tracks which would have fouled the new table. A long cable passing through a snatch block was attached to the new table and extended across the pit to a locomotive directly opposite and on a line with the skid. The engine slowly pulled the table along the greased skidway until the carriage on which it rested was directly over the cap. The two derrick cranes, again standing at right angles to the table, were hooked to slings attached to the center of the table and lifted it so that the carriage and the

Schedule of Operations

Operation	Time
Last engine off old turntable	10:06
Temporary trestle picked up by derrick crane	10:06
Old turning mechanism picked up by locomotive crane	10:09½
Temporary trestle set	10:10
Derrick hooked to old table	10:13
Table moved back and in the clear	10:16½
Derrick removed old center	10:17
Old center in the clear	10:19
Cleaning up old foundation and placing grout	10.27
Old circle rail removed	10:24½
New center block lifted	10:22
Down in final location	10:40
Grout poured	11:01
Building skidway for new table started	10:25½
Building skidway for new table completed	11:07
Locomotive hooked to cable to move new table	11:04
First pull	11:09
Table over center	11:15½
Crane hooked to center to raise table	11:20
New table high	11:21½
Carriage removed from under new table	11:24½
Skidway taken out from under new table	11:25¼
Table let down	11:37
Table set	11:39½
Started to clear up pit	11:42
Pit clear	11:47
Power on	11:50
Motor frame connected	11:50
First turn empty	11:51
First engine on table	11:52

Getting Ready to Lift Out the Old Table

skidway could be removed. The table was then lowered exactly over the center. While the cranes backed off, removing at the same time the temporary trestles on which they had operated, the framework for the motor and wiring were connected on the table. The table was immediately turned without load by the tractor, exactly 1 hr. and 45 min. after the old table turned last. An engine was then run on the new table and turned without a hitch.

The replacement work was in charge of W. H. Kirkbride, engineer maintenance of way; H. A. Hampton, division engineer, and O. V. Chesney, supervisor of bridges and buildings. The engineering details were arranged by F. L. Monroe, assistant engineer; D. S. Weir, assistant superintendent handling the operating details, and Foreman M. G. Kirkpatrick assisted by Foreman H. C. Klinge and L. Hitchcock, superintended the three bridge and building crews doing the actual construction work. A total of 47 men were used in the work.

I. C. C. Investigates Practice of Hiring Labor by Contract

THE Interstate Commerce Commission has announced that it will undertake an investigation of reports which have come to its attention to the effect that the Pittsburgh & Lake Erie is employing maintenance of way labor through an arrangement with contractors. In its order which was dated July 14 but which was not made public until August 5 the commission stated that: "It having been reported to the Interstate Commerce Commission that the respondent Pittsburgh & Lake Erie has, during and since the year 1918, followed a practice of securing and employing its track and other maintenance of way labor by or through contractors who are paid percentages of the total payrolls of such employees, and that the practice has not been and is not consistent with efficient or economical management and has resulted and results in unreasonable, excessive and unnecessary expenditures for maintenance of said respondent's way, track, roadbed and structures:

"IT IS ORDERED, That the commission, upon its own motion, and without formal pleaing, enter upon a proceeding of inquiry and investigation into and concerning the practice of said respondent, during and since the year 1918, in the matter of securing and employing laborers engaged in the maintenance of respondent's way, track, roadbed and structure, and into and concerning the total amount or amounts of respondent's expenditures for such maintenance during said period and with relation to the reasonable cost thereof."

The Pittsburgh & Lake Erie has admitted that this practice is in effect but maintains that it has been demonstrated to be economical and necessary on those occasions when it has been followed. J. B. Yohe, vice-president and general manager, has issued a statement as follows: "The Pittsburgh & Lake Erie has been using contract labor continuously to some extent since 1917. During the war the demand for labor in the mills in the Pittsburgh district was so great that it was almost impossible to secure competent railroad common labor at the wage which the railroads were allowed to pay, and, in order to maintain the road it was necessary to use contract labor. This company has at all times employed directly men as company forces whenever it could secure them and has resorted to the use of contract labor only when necessary. The contractors employed to furnish labor are the general contracting firms of Trelfall & McLaughlin and Corrado & Giliardi, both of Pittsburgh. The class of common labor available during and since the war period has been such that the men would not and could not secure boarding houses along the road where the work was being done, making it necessary for the railroads to provide accommodations for housing and feeding them. All of this common labor is handled directly by railroad company foremen during the working period, but it is hired, paid, housed and fed by the contractors, who also have their own organizations for securing labor. This method of securing and using this kind of common labor has proved to be economical."

CONSOLIDATION ADVANCED.—The merger being promoted by the Nickel Plate interests was advanced one step on August 28 when the directors of the Pere Marquette ratified the proposal to enter the new system which is designed to include also the New York, Chicago & St. Louis, the Erie, the Chesapeake & Ohio and the Hocking Valley. This plan was approved by the directors of the Erie sometime ago.

Large Sums of Money Have Been Invested in Water Supply Works

Cleaning Water Mains Yields Large Returns

Scraping Over 20 Miles Yearly Brings Many Lessons and Large Savings. Half Million Gallon per Day Increase at One Point

By Charles Haydock
Engineer, Pennsylvania Water Companies, Philadelphia

THE CARRYING capacity of cast iron pipe lines is frequently reduced in service much more rapidly than is commonly appreciated because it is seldom that provisions are made for periodical determinations of loss of head and quantity, the two factors necessary to compare actual with theoretical carrying capacity, and thus determine the reduction in or loss of capacity. This reduction of carrying capacity is due to obstructions, which may be local or continuous.

Various Causes of Obstructed Lines

Local obstructions are generally foreign bodies, such as lead from missed joints, dropped gates of valves, and many other things. At various times such things as picks, shovels, axes, lumber, caulking tools, dinner buckets, overalls and stones have been removed from pipe lines. Continuous obstructions are most frequently tuberculation or incrustation on the inner surface of pipe lines. Tuberculation reduces the capacity of a pipe line in two ways. A comparatively small amount may cause a decided increase in friction and consequent decrease in capacity. As the tuberculation grows, a larger portion of the interior surface is covered by tubercles and eventually the entire surface is so covered, which reduces the area of the pipe line and greatly increases the loss in capacity. Such tubercles are composed of iron oxide or hydrate and, while quite hard, can be removed by cleaning the pipe line in place.

Another common type of continuous obstruction is that due to deposits from treating plants. Treating plants in railroad service are notably over-taxed and as a result, sedimentation is frequently incompleted in the place provided for that purpose and continues in the pipe line. These precipitates adhere to the inner surface of the pipe line, increasing the frictional resistance to flow and reducing the diameter, and consequently, the carrying capacity for which the line was constructed. Depending on the nature of the water and the treatment, such deposits may be hard or soft. The hard deposits are of the same nature as boiler scale, although they have not been baked. These are difficult to dislodge, except by the methods commonly used to remove hard boiler scale. The soft deposits can be removed by cleaning the pipe line in place.

Cost Important Consideration

If the deposit in the pipe line is so refractory that it cannot be removed from the pipe line in place, the pipe can be reclaimed, cleaned above ground and then relaid. Under normal conditions, the cost of a cast iron pipe line is approximately equally divided between the cost of the pipe and the cost of excavation and laying. It is thus apparent that if it is necessary to remove a pipe line in order to clean it, the total cost of the work will be very high and possibly approach the cost of a new line. In addition, the time required to clean a line by this process will be so great as to constitute a serious objection. For these reasons, few lines are cleaned by removing the pipe and every effort is generally made to clean a pipe line in place. Cleaning in place is usually accomplished

either by pulling a cleaning device through the pipe line or by using water pressure to force a cleaner through the line, the dislodged deposits being washed ahead by allowing a sufficient flow of water through the cleaner to accomplish this purpose.

The water supply policy consistently followed by the Pennsylvania System has been to secure naturally pure supplies wherever possible. In pursuance of this policy, large sums of money have been invested in storage dams, pipe lines, service reservoirs and pumping stations, to bring pure supplies from distant points to the important water stations and the larger shops, such as at Altoona, Harrisburg and Pitcairn, Pa., and Wilmington, Del. The use of such pure supplies greatly reduces boiler maintenance and repairs, and results in the best operating conditions. A further result of this policy is that the Pennsylvania System has very few water treating plants, as it is generally conceded that the best and most carefully treated water is never as satisfactory as a naturally pure water.

Tuberculation Chief Trouble on Pennsylvania

The soft waters of northeastern United States, though desirable boiler waters, cause considerable tuberculation, as a result of which it has been necessary to clean a number of pipe lines on the system. The majority of these have been cleaned by the Pennsylvania's own water supply organization. Each of these projects has its own particular points of interest and its lessons for future work, as will be gathered from a description of two of the projects undertaken in recent months.

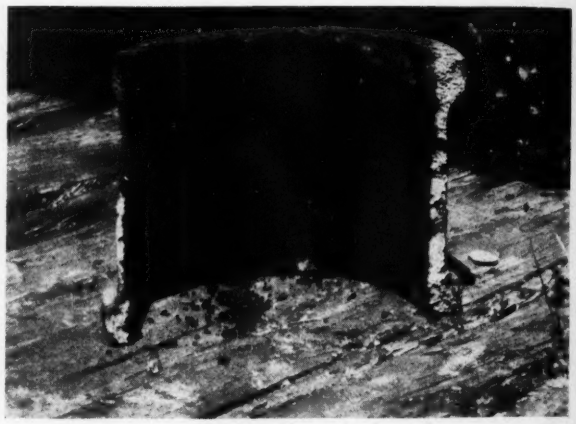
The water supply for the shops at Renova, Pa., on the Williamsport division, about 53 miles west of Williamsport, Pa., and 166 miles east of Buffalo, N. Y., is obtained from a small intake dam on a pure mountain stream. From this dam, the water flows by gravity a distance of 3.2 miles to a reservoir near the shops from which it is distributed by gravity throughout the shops and yards. This line was laid about 1885 with 10-in. cast iron pipe. About 10 years later, the half of the line nearest the intake dam was replaced by 12-in. pipe. Some years later, a small pumping station was built at the shops to secure an emergency supply from the Susquehanna river. The river water at this point is always hard, a representative sample in dry weather showing from 10 to 15 grains of total solids, nearly all of which is sulphate hardness. In addition it frequently is acid to the extent of 2 or 3 grains, by methyl orange measurement, from the drainage of the bituminous coal mines in the Clearfield district. The use of such waters for boiler purposes causes many difficulties in railroad operation which are not present when pure water supplies are used. In 1916, a test of the pipe line supplying the shops disclosed that this line was flowing at the rate of 640,000 gal. per 24 hours, which was somewhat less than the quantity of water required by the shops. This necessitated operating the emergency pumps for several hours each day. As the observed capacity of the line was less than one-half the theoretical capacity, it was decided to clean the pipe.

While the auxiliary supply was a very inferior boiler water and required the continual use of boiler compound, its use greatly simplified the pipe cleaning. By drawing on the storage in the reservoir at the shops and operating the pumps as needed, it was possible to clean the line without interfering with the service in any way. At the upper end of the line there was practically no pressure, and it was necessary to pull the cleaner through the first 2,000 feet of the pipe line by means of a winch. The work was started by opening the pipe line a short distance below the dam and floating through the pipe line a sawdust bag, carrying a light wire cable, which was used to pull a heavier cable attached to the cleaner. The cleaner was then pulled through by means of the winch.

At the lower end of the section thus cleaned by hand, the pressure was about 15 lb. As this was sufficient to move the cleaner, the balance of the work was done in that way. The cleaner with a pressure head attached was then placed in the line, the pipe sealed up and the pressure turned on, causing the cleaner to move forward through the pipe. The section thus cleaned extended to the end of the 12-in. line, a distance about 1½ miles. The cleaner passed under the creek several times without difficulty.

Dye Helpful in Detecting Leakage

After the 12-in. portion of the pipe line had been cleaned. it was found that the observed flow, as determined by a pilot tube and recorder located near the intake, was greater than the theoretical capacity, indicating that there was considerable leakage from the pipe line, although there were no surface indications. This water supply was not used for drinking purposes and it was therefore possible to locate the leaks by placing dye in the pipe line and watching for the appearance of the dye



A Piece of Pipe Showing the Character of Incrustation Encountered

in the stream or ditch. The dye used in making the tests was uranine. This is a brilliant red powder which when dissolved turns orange at first, then yellowish green, and finally pale green as the dilution increases. It is very persistent and does not readily filter out in passing through the ground. A pound of this dye will impart a readily appreciable greenish tinge to about 10,000,000 gal. of clear water. As a result of using the dye two large leaks were found, one in a creek crossing and the other in a rocky trench where the water escaped to the stream without appearing at the surface. A number of smaller leaks were also located by the use of dye and aquaphones.

The 10-in. pipe line was much more difficult to clean because the tuberculation was much thicker and more firmly attached and it was found by inspection that the line had actually been reduced to a diameter of not much more than 8 in. By reason of the smaller diameter, there was less pressure to force the cleaner along although the water head was somewhat greater. It was necessary to divide the 10-in. pipe line in sections for cleaning and to run the cleaner through each section twice to avoid clogging.

The velocity of the cleaner was maintained at about that of a fast walk. This was controlled by regulating the supply of water forcing the cleaner forward and also

by regulating the blow-off at the lower end of the line where the waste water and dislodged tubercles were discharged. This pipe line had been very carefully laid practically to a sewer grade. There was very little foreign matter in the line, but at one point, a piece of lead nearly four feet long, containing sufficient lead to pour about two joints, was found. This rolled into a ball in front of the cleaner and prevented its further progress, so that it was necessary to cut the line at this point to remove the lead and repair the cleaner.

Pitot Tube for Checking Flow

In passing through the pipe line, the cleaner makes a scraping noise, which can readily be heard. The use of aquaphones or similar devices is unnecessary unless the pipe line is quite deep or along a railroad or some other noisy place. The pitot tube and recorder, used to measure the quantity of water flowing in the pipe line, was set up a short distance below the intake dam at a point where the pressure was sufficient to give a satisfactory record. These recorders are portable devices, used to measure the velocity at a given point in the pipe line, and from this the quantity is obtained by multiplying the area by the velocity and a constant, based on the tube coefficient and the location of the orifice. As the area of the pipe is affected by tuberculation, this method is only accurate when the pipe is reasonably clean. The purpose in locating the measuring station near the dam was to use a single station for the entire work, and also to secure a record of all the water flowing in the pipe line, which would assist in locating any leaks. The location selected was naturally of the greatest benefit for this purpose, as shown above.

The decreased capacity of this pipe line was not due entirely to the tuberculation. The leakage was so great as to be a serious drain on the capacity of the line by pulling down the hydraulic grade line to the points of leakage and thus reducing the head available to cause flow into the reservoir at the shops. Repairing the leaks alone, without cleaning the line, however, would not have increased the capacity sufficiently to meet the demands, and the entire benefits derived can properly be credited to the cleaning job, because the leakage would not have been discovered if the pitot tube recorder had not been used as a part of the cleaning job.

Dispenses with Emergency Pumping Plant

When the line had been completely cleaned and again placed in service, it was possible to deliver 1,300,000 gal. into the reservoir each 24 hours, a quantity slightly more than twice as great as the capacity before cleaning. This quantity of water was considerably in excess of the requirements of the railroad and it was thus possible to dispense entirely with the emergency pumping station. A further result was that the locomotives were thereafter furnished with a full supply of pure, soft water, instead of a mixture of good water with the hard, acid water obtained from the river as an emergency supply.

The water supply for the Scully Yards, a few miles west of Pittsburgh, is pumped from the Ohio river at the Esplen pumping station to two 500,000 gal. steel standpipes, from which it flows by gravity to the yards through 2.66 miles of 10-in. cast iron pipe line, laid in 1913. The river at this point always contains considerable permanent hardness, an average analysis showing from 15 to 20 grains of total solids, about half of which is magnesium sulphate. This water is also frequently acid, from coal mine drainage. In order to neutralize the acidity and soften the water, it is treated at the pumping station with soda ash and Altoona boiler compound, but no settling basin is provided to permit the precipitated salts to settle out.

When originally laid, and for some time afterwards, the capacity of this line was ample for the needs of the yard, but recently it has been necessary to purchase water locally in order to supplement the supply delivered through the pipe line. A preliminary examination of the pipe line last year showed that it was carrying much less than its theoretical capacity and a more careful test was then made. This was accomplished by means of a pitot tube and manometer to measure the flow, and three recording pressure gages to determine the pressure at various points. No coating or deposit on the interior of the pipe could be detected when the inside diameter of the pipe was measured by the pipe caliper, but the hook end of the caliper was found to retain a greasy substance. Considering it advisable to examine the interior of the line, service was discontinued for about half an hour and a one inch corporation cock removed. By feeling inside the pipe a soft deposit, one inch thick, was found to cover the entire interior of the pipe. Since the pitot test, together with the hydraulic grade line determined by pressure gages indicated a uniform and excessive loss of head through the entire pipe line, it was certain that the entire pipe line must have a similar coating. Cleaning the line was therefore prescribed.

Rapid Work Imperative

As this line supplied a yard and the local storage was limited, it was necessary to do the cleaning as rapidly as possible, in order to avoid trouble from water shortage. The water pumped from the river is not used for drinking purposes. Such water is purchased from a local water company and, as stated above, some water was purchased as an auxiliary supply to make up the yard supply. This purchased water, with the local storage of 150,000 gal., provided a sufficient supply while the line was out of service for cleaning.

The line was divided into two sections for cleaning because of a short section of pipe in the line six feet long, laid at right angles to the rest of the main approximately two-thirds of the distance from the pumping station to the yard. Since these right angle turns were made with flanged tees, it was not necessary to cut the line to remove the cleaner as the blank flanges could be removed more easily. At 9 a. m. on December 3, 1923, the line was removed and a cut made at a point 375 ft. from the beginning of the 10 in. line for inserting the cleaner. Local conditions made it impossible to make the cut closer to the end, and it was believed that leaving this short section uncleaned would not marterially affect the results. The interior of the pipe at this point was found to be coated with soft mud. The surface of this coating of mud and precipitate, where exposed to the water, was slightly hard and resisted being washed out by water alone, but about 150 ft. of the line was readily dislodged by wire brushes attached to sewer rods. On removing the mud, the pipe coating was found to be in excellent condition and only a few small tubercles were present, indicating that the loss in capacity was due entirely to reduced diameter as a result of precipitation in the pipe line and not due to tuberculation.

After cleaning this short section by hand, the cleaner was inserted in the pipe line and the line sleeved up. In the meantime, the blank flange on the first tee, about one and one-half miles away, was removed to provide an outlet for the cleaner. A blow off valve was located one-half mile from the point at which the cleaner was inserted and because of the large amount of material to be removed, it was considered advisable to use this blow off rather than

attempt to carry all of the material removed the entire mile and one-half to the point where it was proposed to remove the cleaner. The static pressure for the first cut was approximately 144 lb.

Cleaner Travels Mile in 45 Minutes

This pressure was turned on at 3 p. m. and the machine moved forward, forcing the mud ahead of it. There was so much thick mud in the line and it contained so many lumps that it oozed rather than flowed out of the blow off. The cleaner moved steadily along the line and reached the blow off without trouble, but the water continued to flow muddy for about 10 min. The blow off was then closed and the machine forced along the line to the opening where it appeared at 4:25 p. m. The time of cleaning was thus one hour and 25 min. Deducting a 10-min. interval at the blow off, the cleaner traveled a distance of 8,956 ft. in 1¼ hours, or at a rate of one mile in 45 min. The line was permitted to flush for some time and after the water entirely cleared, the blank flange was replaced. A small amount of water was turned on at six p. m., and full service was restored at 6:30 p. m., just 9 hours and 30 min. after the line was taken out of service, during which there was no interruption to the yard supply

The second section of the line was taken out of service at 9:33 a. m. on December 5. A blow off approximately a half mile beyond was used to relieve the line in the same manner as when cleaning the first section. The water was turned on behind the cleaner at 3:15 p. m., and reached the blow off in 15 min. A part of this section of pipe line was under a 20 ft. enbankment but fortunately no obstructions were encountered. If the machine had stopped in this part of the line it would have been difficult and expensive to locate and remove it. Since difficulties were expected in this section, however, the pipeline was not cut to remove the cleaner until after it had passed the blow off. The line was then cut about 500 ft. beyond the blow off and water turned on to clean this remaining section. The coating at this end of the line was found to be about three-quarters of an inch thick. The cleaner was removed at 5:15 p. m., and full service was resumed at 7:45 p. m., 10 hours and 15 min. after the line was taken out of service

A total of 12,438 ft., or 87.5 per cent of the 10 in. pipe line was cleaned. The portions not cleaned were located in the middle of a street, under a driveway and beneath yard tracks. It was not considered advisable to attempt to clean them on account of the hazards and because it was not necessary, it having been previously estimated that 8,000 or 9,000 ft. of cleaned pipe line, with the balance uncleaned, would supply sufficient water for the uses of the yards during conditions of maximum demand. It is estimated that 60 cu. yd. of material, comprising the mud and precipitation, were removed from the pipe line by the cleaning operation.

Yield Increased Half a Million a Day

Since cleaning the pipe line it has only been necessary to purchase drinking water for the yards, as the entire engine supply can be furnished from the Esplen pumping station. During the year 1923, 42,081,000 gal. of water was purchased at a cost of $6,516. Detailed costs of the cleaning were not kept, as it was done simply as an item of maintenance, under the supervision of an assistant engineer, who has done practically all of the company's pipe cleaning. The cost of the work, however, was small in view of the savings. As a result of the cleaning operation the pressures in Scully yards have been about doubled and the quantity delivered from the Esplen station increased approximately 56 per cent or from a rate of 950,000 gal. per day, before cleaning, to a rate of 1,387,000 gal. per day, after cleaning. The estimated average consumption at the yards is 800,000 gal. per day, on which basis the quantity of water purchased in 1923 comprised 14 per cent of the total quantity used.

The theoretical capacity of this pipe line under normal operating conditions is 1,670,000 gal. per 24 hours. The pipe line is under high pressure throughout and for this reason is of heavy pipe, which actually calipers 9¾ in. in diam., on which the capacity is based. This theoretical capacity makes no allowance for the bends and valves in the line, but assumes the pipe line to be straight and cleaned from end to end. As the observed capacity after cleaning was 1,387,000 gal., the result of cleaning 88 per cent of the length of the line was to restore the capacity of the entire line to 83 per cent of that of a new line. The straight portions cleaned indicated capacities equal to new line.

Twelve Years of Pipe Cleaning

The experiences of the Pennsylvania System in pipe cleaning indicate that this process is a valuable aid in the operation of water supply systems, the importance of which in many instances is not fully realized. It is by no means a cure-all, but is simply an additional tool, which in the hands of experienced men, will yield satisfactory results, but which like other complicated tools and processes, cannot be expected to operate economically and satisfactorily in the hands of incompetent or inexperienced persons. The Pennsylvania's experiences with pipe cleaning extend over a period of 12 years, from 1912, when the first lines were cleaned by a commercial company, to the present time, when three different jobs are under way with company forces. The cleaners used have been developed to the present design by successive stages. In 1923, approximately 25 miles of pipe line were cleaned. This year's program includes about the same mileage. Next year's program is already in preparation and will involve a similar mileage. All of these pipe lines carry water of a high degree of purity and the loss in capacity is due entirely to tuberculation, caused by the action of the water on the pipe.

An Example of the Results of Cleaning (The Mirror was Inserted to Reflect Light for the Photograph)

The length of life of the beneficial results of cleaning has not been definitely established, as this depends so much on local conditions. It can certainly be no more

permanent than the original capacity, and is probably less so. This is a natural condition because if the loss in capacity is due to the presence of hard tubercles in the interior of the pipe line, these can only be removed by a rigorous cleaning operation, which necessarily impairs the coating to some extent. Consideration has been given to the possibility of renewing the coating in the line under ground, but no practical and economical process has yet been developed for this.

Important to Find Preventive

Pipe cleaning is not a true remedy for the condition of loss of carrying capacity of cast iron pipe lines. A true remedy would be to establish conditions which would prevent this rather than to remove it after it has occurred. To accomplish this result, two lines of procedure are indicated: Treatment of the water to render it less active in its attack on the pipe line, and treatment of the pipe line to render it more resistant to the attacks. Treatment of the water has all of the well-known disadvantages of treating water for any other purpose, and no treatment so far devised will operate satisfactorily and economically in view of the conditions and quantities involved. Practically all of the methods proposed would impair the desirability of the water to some extent for boiler feed purposes. Treatment of the pipe line seems more promising. This naturally divides into two general methods —increasing the resistivity of the pipe to corrosion, and increasing the degree of protection afforded by the coating. Improving the coating does not have as attractive possibilities as improving the metal, for the reason that any impairment of the coating immediately opens an avenue of attack on the underlying metal. The coating in general use is a hot dip of tar, and the tubercles develop at the air bubbles in the coating or where the coating has been injured by abrasion. There have been interesting experiments in different types of coatings which give some promise of results. The most promising seem to be cement and a higher grade of tar, applied in a thicker coat. Improvement of the metal in the pipe line may possibly be accomplished by the addition of other materials.

Fall Track Work

By C. H. Carpenter

THE FALL months are very important for the track foreman. At that time he must do some of his most valuable work. All bad places in the track should be put in good shape and all ditches should be cleaned so as to drain properly. Points where landslides occur should be gone over thoroughly, and if anything can be done to prevent sliding it should be done before the wet weather sets in. Often landslides can be prevented by ditching surface water around and away from the head of the slide. A few hours of work of this kind in dry weather may prevent many hours of hard work in a muddy slide later, and also avoid train delays.

In the matter of drainage it is hardly possible to do too much. Nothing has such a bad effect on track as poor drainage. All ditches should be well cleaned out, but the spoil taken from ditches should not be thrown above the ditch where it will wash back in. If necessary it should be trucked away so that it will never be necessary to rehandle it. Drain pipes should be cleaned out and, where needed, wire screens should be placed at their heads to prevent debris from flowing into the drains and stopping them up.

Rails should be thoroughly inspected before cold weather and any defective ones replaced. Every track man knows how easily rails break in the first cold snaps of the winter. A thorough inspection of rails may locate some defective ones, the removal of which may prevent an accident later.

All side tracks should be gone over and put in good shape. All road crossing should be given attention and be in good condition before bad weather sets in, as a road crossing is hard to handle in the muddy season. All bolts and spikes should be tightened snugly and track well gaged.

To summarize the whole fall program the following work should be done:

Put track in good line and surface,
Open ditches and drains,
Ditch above land slides,
Inspect rail and renew defective ones,
Put switches in good shape,
Go over side tracks thoroughly,
Put road crossings in good condition,
Regage track,
Drive spikes to the rail,
Tighten bolt.

If all of these details are carefully looked after by the track foreman in the fall he can rest assured that the coming winter may be looked forward to with real satisfaction, and when cold weather comes he can put in his time on regular winter track work.

Put Motor on a Rail Layer

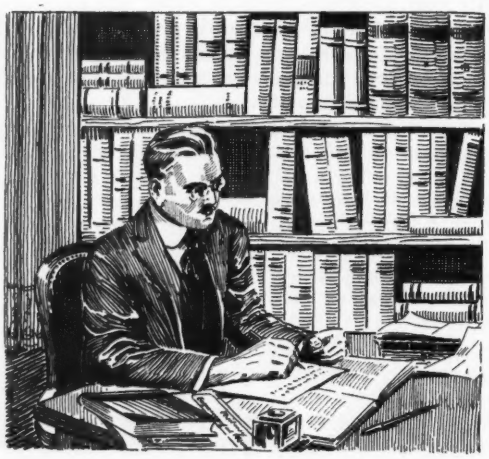
THE MADDEN rail layer is designed for manual operation. However, the maintenance forces on one railroad have found it of advantage to equip a machine of this type for power operation. As shown in the photograph, a four-horsepower Fairmont gas engine has been applied, providing a suitable bracket constructed of angle irons, on which to rest the engine.

The Gas Engine in Place

A 3-in. fibre pulley was applied to the end of the engine shaft and this engages a 24-in. iron pulley which was substituted for the crank on the winch shaft of the rail layer. Power is applied or released by means of the shifting lever on the engine, while the rail is held at any desired height by means of a foot brake. Under this arrangement the engine is not positively secured to the rail layer, so it may be lifted off the bracket readily at any time that it is necessary to remove the machine from the track.

We are indebted for the above information to G. G. Smart, general roadmaster, Great Northern, St. Paul, Minn.

What's the Answer?



This department is intended to help our readers secure answers to the questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. An endeavor will be made to answer promptly by mail, any questions received. Such questions as are of general interest will also be submitted in these columns for further discussion. *Railway Engineering and Maintenance* solicits the co-operation of its readers in answering the questions which are published.

Questions to be Answered in November Issue

1. When installing tie plates, is it good practice to spot them in as ties are renewed or should they be inserted out of face?

2. Should water columns be provided with locks or other devices than those furnished by manufacturers to prevent them from being thrown across tracks?

3. To what extent is it practicable to build or repair fences during the winter?

4. Is it possible to ascertain the condition of flat tank hoops without removing them from the tank? If so, how?

5. What is the most satisfactory time of the year in which to tighten bolts out of face?

6. Is it preferable to supply paint gangs with pigments and oils to be mixed on the job or with ready mixed paints?

7. How should one proceed to start a motor car on a cold morning?

8. Is the dapped guard or fender timber on bridge floors preferable to other means of spacing ties or securing them against bunching?

Giving Old Ties Away

To what extent is it practicable to dispose of old ties to residents along the line? What objections, if any, are there to this practice?

First Answer

The Great Northern permits farmers to remove from the right of way all ties that have been taken from track and are unfit for further use. Sometimes this privilege is exchanged for the right to erect snow fences on the farmers' property. The farmer is required to remove the ties from the right-of-way within a reasonable time, otherwise the section foreman piles and burns them. To some extent scrap ties which supplement car scrap are used in the heating plants in the car shops, but aside from this use the company makes no effort to salvage scrap ties. Attempts to do so have not shown that a saving can be effected by the practice.

J. R. W. Davis,
Engineer Maintenance of Way, Great Northern, St. Paul.

Second Answer

Where the country is thickly settled it would no doubt be an easy matter to dispose of the entire quantity of old ties removed from the track to residents along the line, although I do not favor this practice to any great extent. However, in yards and around towns where it is not practical to burn the old ties on account of the fire hazard it is the cheapest way of getting rid of them.

On my district we use the old ties for burning out stumps on the right-of-way, my motto being "A stump for each pile of old ties." Where the right-of-way is fenced, we pick out enough of the best old cypress ties and save them for fence posts. In giving the old ties away there is of course the advantage of the parties moving them from the track, thereby saving the labor of the section force in piling them.

This advantage is offset, however, by allowing the parties to trespass on the right-of-way with teams and possibly in some cases remove new ties along with the old ties or other good material when there is no one present to supervise the loading and carrying off of the old ties.

W. T. Pace,
Roadmaster, Atlantic Coast Line, Live Oak, Fla.

Third Answer

In those states where considerable grain is grown it is often the practice to sell or allot to each farmer or ranchman a certain number of ties at about 2 or 3 cents per tie, in payment of the plowing of a fire guard on his land in order to protect the grain or the stubble. This saves claims which would naturally arise from burning the right-of-way and works out very satisfactorily.

If a foreman or supervisor is going to give away old ties along the right-of-way to every one asking him for them, someone is going to be called upon for an explanation. Ties taken out can be stacked up and loaded and used at outlying pump stations, and in and about small terminals for firing up boilers, etc.

In a prairie country where wood is hard to get one can generally secure a fair price for ties and they are hauled off as taken out. It is important, however, to be

careful in handling the money, for if the transaction is not regular the sale of ties will cause trouble sooner or later. I would not recommend their sale unless as outlined above in payment for the plowing of fire guards and then that part should be in writing for the protection of all concerned.

GEO. W. KOONTZ,
Division Engineer, St. Louis-San Francisco, Ft. Worth, Tex.

Treating Water in Reservoirs

Under what conditions, if any, may water be chemically treated in reservoirs and how should the work be done?

First Answer

Once in a great while it may be advisable to treat water in a reservoir but I do not approve of the practice, as it is expensive and the results are not entirely satisfactory. If, for some reason, the water in a reservoir becomes exceedingly high in temporary hardness, or if work trains and steam shovels are required to operate for a considerable period on reservoir water with a fairly high temporary hardness, a considerable saving can be made by treating the water with hydrated lime in the reservoir.

A raft, large enough to carry considerable lime, is built and from this the lime is sprinkled over the top of the water by one man and stirred with an oar by another. The results will be more satisfactory if this work is done on a fairly windy day. The raft should be pulled back and forth across the reservoir with ropes snubbed to posts set about 25 ft. apart so that the lime will be put in as evenly as possible. Tests should be made after the reservoir has been completely covered and more lime added if necessary. More lime is needed to give results by this method than in treating plants, as some of it settles to the bottom in lumps and does little good.

B. W. DE GEER,
Engineer Water Service, Great Northern, St. Paul, Minn.

Second Answer

My first chemical treatment of water in a reservoir was on the Great Northern in North Dakota late in the winter of 1911, when the reservoir was covered with 24 in. of ice. In summer the reservoir bottom was full of weeds, which began to die and decay in late autumn, with the evolution of gases, one of which in the end became hydrogen sulphide (the gas from rotten eggs), an acid gas very destructive of boiler tightness. As long as the water was free to discharge this gas into the atmosphere no great damage was done to the boilers, though enginemen were careful to take as little of the water as possible; but when the reservoir became covered with ice and the gas began to accumulate in the water under the ice this station was passed by everyone.

Late in the winter, however, other water supplies began to run low, and one morning every freight engineman had orders to take water at this place. During the day word came from one train after the other "Boiler leaking, just made siding so-and-so," and not one train reached the end of the engine district.

A sample of water was secured from the pump, a field analysis made, and the water content of the reservoir estimated, whereupon a few tons of fresh lime was obtained and a crew of men with crowbars assigned to chop 12-in. holes through the ice, 6 ft. apart. No one realized the pressure of gas under the ice. While the holes were being cut, a smaller crew built a fire near the reservoir edge and slacked lime in a large kettle. Other men cut trees nearby into 20-ft. poles, and as one man poured a pail of milk of lime down a hole another vigorously stirred the water underneath with a pole. By dark that evening the holes were all cut, the slacked lime poured in, and the water stirred. The next morning, the hardness of the water was down to nine grains per gallon and the water satisfactory for boiler use.

The next reservoir treatment was for a water which contained 50 grains per gal. of sodium carbonate, and could not be used in that condition because all of the other waters on that engine district were plain hard waters and this water loosened the scale and caused immediate leaking. The proper treatment for the water was with lime and iron sulphate, leaving the water alkali but not alkaline.

Two rafts were made of railroad ties, as it was summer time. One loaded with lime was poled slowly over the reservoir, using unslaked lime. When the proper amount of lime was in the water the rafts were loaded with sulphate of iron, which was dissolved in the water as the rafts were poled about. I do not know of any better method, except that the stirring might have been improved at the latter reservoir.

C. H. KOYL,
Engineer Water Service, Chicago, Milwaukee & St. Paul, Chicago.

Where to Start Tie Renewals

Is there any merit to the suggestion that a foreman should start renewing ties at the end of his section most remote from his headquarters and work continuously over his section?

First Answer

On account of special conditions of grades, curvature, unstable roadbed, etc., it has not been possible to follow very closely any set program for overhauling track on the Louisville & Nashville. The selection of the places where the track should be overhauled and the manner of handling the work are given special consideration in all cases by the roadmaster and track supervisor, who are governed entirely by the local conditions. I cannot see that there would be any special advantage in having a foreman start renewing ties at the remote end of his section.

J. R. WATT,
General Roadmaster, Louisville & Nashville, Louisville, Ky.

Second Answer

I can see no merit in starting a foreman at the end of his section most remote from his headquarters when renewing ties, but rather two adjoining sections should be started on their adjacent ends as this brings a greater amount of finished track in a continuous stretch. In all cases except where track is unsafe the installation of ties should be continuous from the starting point.

G. T. DONAHUE,
Assistant Supervisor of Track, New York Central, Rochester, N. Y.

Third Answer

If the work of renewing ties out of face is started in the spring of the year with the sections back to back and is then pushed towards home for four days per week with one day and a half spent in going over the section "sniping up" and one half day around the tool house and station grounds, each foreman should finish a nine mile section of single track, with 6 men, in 3 to 4 months. If any heavy renewals are to be made it will be necessary to figure on an extra gang for protection. If the section gang will follow out this program and at the same time put in line and surface that portion

of the track which they tie up each day, a good looking section will be the result but if they skip around and tie up anywhere, winter will come when they least expect it.

G. W. KOONTZ,
Division Engineer St. Louis-San Francisco, Ft. Worth, Tex.

Fourth Answer

There can be no set rule on this. On gravel ballast and where re-tieing operations start early, men will always start where the gravel is clean and dry. In any kind of ballast it is always best to start early nearest headquarters to avoid long trips to the remote end of the section while the weather is stormy. The continuous work of surfacing and lining should be started at the far end of section later, and the work continued in the homeward direction.

ANDREW M. CLOUGH,
Supervisor of Track, New York Central, Batavia, N. Y.

Crowning Concrete Roadways

When building concrete roadways to serve team tracks, etc., should the surface be crowned and, if so, how much? Should the subgrade also be crowned?

First Answer

It has been the practice to crown streets and highways since the very beginning of highway construction in ancient times. About the only exception to this has been encountered in the case of very narrow streets or alleys which have frequently been sloped to the center line for drainage. There is one obvious reason for the crowning or dishing of roadways—to secure adequate drainage. Another consideration which has had a considerable influence is that of strength—this also has led to an increase of the height of the roadway at the center line for the purpose of obtaining a greater thickness of the construction at the point where the traffic is the heaviest. Crowning has one important disadvantage—its inconvenience to the user of the highway. On a roadway used primarily for longitudinal traffic a heavy crown produces an uncomfortable side tilt of the vehicle which has the effect of concentrating all traffic on the center of the roadway where the vehicles can be effectively centered. On a roadway serving team tracks, docks or warehouses, where considerable turning and backing in is done, the transverse grade produced by crowning introduces some difficulty in handling the vehicles.

The introduction of concrete roadways has resulted in a marked change in the attitude towards the necessity for crowning and the amount of crowning required. The elaborate service tests of concrete highways which have been carried out during the past two or three years and the scientific analysis of the mechanics of the concrete slab used as a highway have both demonstrated conclusively that no benefit from the standpoint of strength is to be derived from an increase in the thickness of the concrete slab in the central portion. In fact, the very contrary of this has been shown and modern practice tends toward an increase in the thickness at the outer edges. This obviates the need of any crowning of the concrete slab for considerations of strength.

With concrete slabs in roadway construction as with other forms of construction presenting an impervious and a relatively smooth top surface, it has been possible to make appreciable reductions in the amount of crowning or dishing required to take care of drainage, with a resultant advantage in obtaining a greater distribution in the traffic over the entire width of the roadway and in facilitating the handling of vehicles in turning, backing or moving transversely to its length. The amount of crown to be provided is dependent on the slope required to compensate for the natural irregularities in workmanship to be expected in practical construction, in other words, enough slope must be provided to insure that there will be no depression which will hold water after a rain. Practical experience with concrete construction indicates that a slope of ¼ in. to the foot is adequate.

The question of the crowning of the sub-grade is entirely one of the design of the concrete slab. The subgrade should be given whatever shape is necessary to meet the requirements of the slab as regards crown and the thickness at various points in its width.

Second Answer

In building concrete roadways to serve team tracks, etc., the surface should certainly be crowned, the amount of the crown being equivalent to ¼ in. per ft. of half width of the roadway. With an impervious surface of this character, it is not necessary to crown the subgrade, except where economy in the thickness of the concrete pavement is desired.

M. HIRSCHTHAL,
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Protecting Poles and Posts When Burning Grass

When burning the right-of-way what precautions should be taken to avoid setting fire to poles and posts?

First Answer

Care should be taken to clean out and scalp back from the poles and posts for a distance of at least three feet, and then if necessary back fire against this. A precaution in firing that is important in this section of the country where we have pastures which are very large, is to have this cleaning wide enough and backed fired a sufficient distance so as to prevent a fire from jumping over it with a change of wind. We generally try to get the fire started from the right-of-way line in against the wind to the main line, in which case, of course, we work away from the pole and fence line. But as stated above, these are cleaned and scalped before we fire.

G. W. KOONTZ.
Division Engineer, St. Louis-San Francisco, Ft. Worth, Tex.

Second Answer

It is the custom of the Atlantic Coast Line to burn the right-of-way in the fall of the year, after the frost dries the weeds and grass enough to burn. This burning off is invariably done just ahead of the annual roadmaster's inspection in December. In many places the road is fenced on each side of the right-of-way, woven wire being used in some cases with a strand of barb wire on top. In most cases old cypress ties are used for posts. There is also a telegraph line on the right-of-way with cypress and chestnut poles. These poles and posts do not catch fire very easily, while the mile posts are concrete in most cases with occasionally an old wooden post. The telegraph poles and mile posts are all grassed around each year ahead of the burning of the right-of-way, as a result of which very few telegraph poles and mile posts are burned.

The fence posts are not grassed or cleaned—and precautions must be taken to keep the fence from being damaged by the fire. In burning the right-of-way the foreman is instructed to catch the wind blowing towards the track and then to fire the right-of-way on the edge farthest from the track, allowing it to burn towards the track. He stations his men along the edge of the right-of-way with brushes to keep the fire from spreading to private property and also to put out any fence post that

may catch fire. Only short sections of the right-of-way are fired at one time. In this manner each foreman goes over his entire section and we seldom have any loss from post or poles or claims for damage to outside property.

W. T. PACE,
Roadmaster, Atlantic Coast Line, Live Oak, Fla.

Steel Plates for Freighthouse Runways

Do steel boiler plates make suitable freighthouse runways where the trucking is heavy? What thickness should be used?

Lines of steel plates installed in a longitudinal direction on freighthouse floors or platforms where a large amount of continuous longitudinal trucking is done have performed effective service in many places in this country. In general, however, their use has not been embodied in the floor construction of new modern freighthouse installations. The selection of some approved type of wear resisting floor which will insure a good surface over the entire freighthouse and platform area is much to be preferred.

In old houses or on old platforms where the floor surface is none too good, especially on long transfer platforms where the preponderance of the traffic is in a longitudinal direction for a considerable distance the steel plate runways are performing good service.

Owing to the fact that it is difficult to provide a flush joint between the steel plates and the adjoining floor surface some difficulty is experienced in running the trucks from the floor onto the runway. Therefore, unless the prevailing traffic involves the longitudinal trucking along the runways for considerable distances their use does not offer any particular advantage.

With regard to thickness, it has been found that No. 10 gage sheets serve this purpose very well. In fact, this thickness is preferred to a greater thickness owing to the increased obstruction offered in running trucks on to and off of the runway.

Surfacing Heavy Traffic Track

How often should track carrying a heavy high speed traffic be surfaced out of face if ballasted with gravel? With rock?

First Answer

Track carrying a heavy high speed traffic and ballasted with rock should be surfaced out of face once every two years. Track surfaced out of face will need only a small amount of nipping-up the following year with a little touching up in the line to produce good riding track. The second year the average track will need more or less surfacing and if given 1-in. or 1½-in. raise, will provide first class riding track and allow cheaper installation of ties and such installation will not disturb the old road bed and will add to the life of the road bed and fastenings. Track carrying similar traffic ballasted with gravel will also need surfacing out of face every two years.

G. T. DONAHUE,
Assistant Supervisor of Track, New York Central, Rochester, N. Y.

Second Answer

The frequency with which a well-maintained line carrying a heavy, high-speed traffic should be surfaced out of face depends largely on the density of the traffic. On the average it can be said that a line of the class inferred by the question should be raised once in every four years, the amount of lift not exceeding two inches. During a four year period under heavy traffic, a track will settle approximately that amount. While rock ballast holds up much better than gravel ballast, the same statement is generally applicable to both kinds of ballast. It may be advisable in sections of particularly heavy traffic for the line to be surfaced out of face at least every two years. On the other hand, a minimum period of time for track over which there is any considerable amount of traffic will be about six years. A well-maintained high-speed, heavy traffic line should be gone over every two years in detail, removing and cleaning all ballast, re-tieing, re-surfacing and re-lining the track and generally putting the track in first class condition. With a fixed program of this nature, one-half of the line is thus thoroughly renovated each year and as a part of the program one-fourth of the line is surfaced out of face, the raise then being made on clean ballast, which is, of course, preferable. This alternating method provides a well-maintained track with a sufficient amount of clean ballast under the ties, insures good drainage, good line and surface and a minimum amount of weeds.

A. J. NEAFIE,
Principal Assistant Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Third Answer

Track carrrying heavy high speed traffic, if ballasted with gravel, should be surfaced out of face every three years and if ballasted with rock, four years. The division under gravel ballast should be split into three parts. By pushing the work systematically, taking one section each year, the track can be surfaced in the period set without trouble.

G. W. KOONTZ,
Division Engineer, St. Louis-San Francisco, Ft. Worth, Tex.

Strutting Culvert Pipe

Is it advisable to place struts in culvert pipe when laying until the fill is thoroughly compacted?

First Answer

The experience on the Chicago, Burlington & Quincy is that it is advisable to put struts in concrete pipe culverts where the fill exceeds 30 ft., other conditions being favorable. This takes care of the heavy initial load on the pipe due to settlement of the fill, and the struts can be removed after this settlement has taken place.

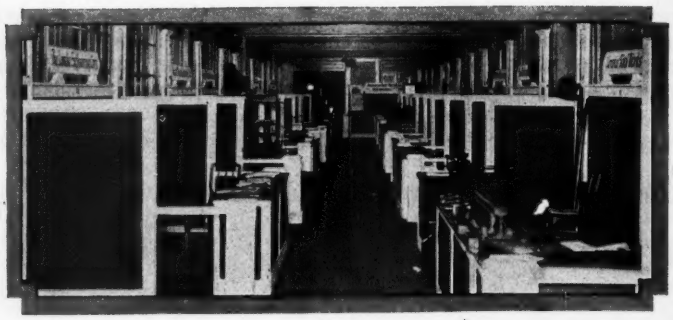
In some cases where a rather large pipe is used, having ample opening and there is no likelihood of trouble from blocking by drift, the struts are allowed to remain in until they rot out, but ordinarily they are removed. For this blocking second-hand 8-in. by 8-in. bridge ties are generally used, placing a row longitudinally in the bottom and top with vertical posts spaced about every three feet between. Wedges are used to take up the slack between the bottom of the post and the bottom row of ties.

Only two serious cases of cracking of concrete pipe due to the weight of the fill have been encountered. One of these occurred where a pipe was laid in a trench about 8 ft. deep, and a 45 ft. fill was placed on top of it. The supporting bench was omitted, as it was thought that the earth on each side of the trench would support the fill to a great extent and take the load away from the pipe. The heavy fill, however, compressed the natural earth to such an extent that the pipe did receive a very heavy initial load, causing the center sections to crack.

G. W. HAGGANDER,
Bridge Engineer, Chicago, Burlington & Quincy, Chicago

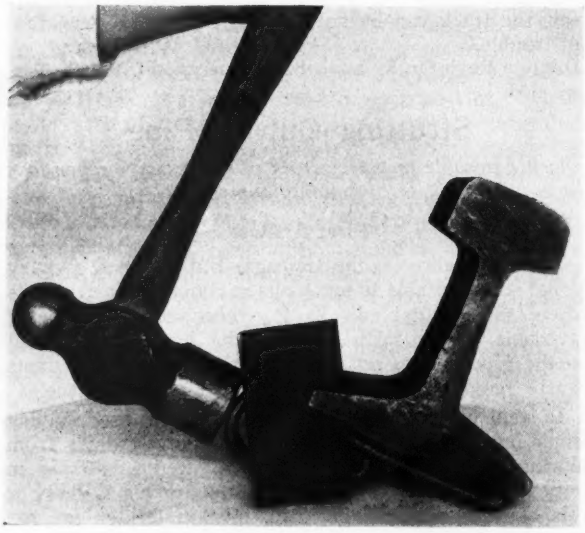
[T. T. Irving, chief engineer, Canadian National, Central Region, is of the opinion the concrete pipe should be of sufficient strength to obviate the use of struts which tend to cause obstructions. Editor.]

New and Improved Devices



A New Rail Anchor

THE FACT that the Canadian Pacific and the Canadian National railways have installed over a half million rail anchors of the Stead type, indicates that this device has passed the experimental stage. This device is essentially a two-piece anchor which utilizes a spring key to hold it in place, the photograph showing the form of anchor and the manner in which it is applied. That portion of the anchor which takes up the thrust of the creeping consists of a flat bar of steel bent U-shaped and provided with a notch on one side cut about one-half the distance up from the base of the U-shape and extending



The Stead Rail Anchor in the Process of Application

inwardly at an angle. This permits the U-shape to be slipped over the edge of the base of the rail in such a manner that when in position the closed end extends well under the base.

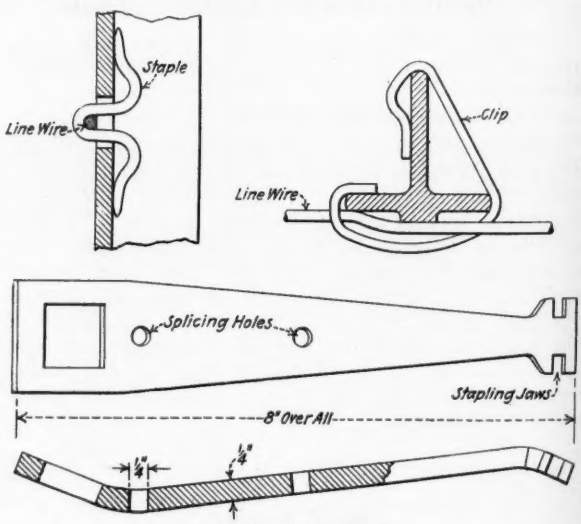
The angular position taken by the clamp on the rail also forms a V-shaped opening between the closed end of the clamp and the under side of the rail over which the clamp is inserted. This V-shaped opening furnishes the means of holding the clamp in place, which is done by inserting the spring key and driving it forward under the rail until the hook on the end of the spring snaps over the edge of the rail base. The head of the spring, which consists simply of a loop, fits tightly in the wedge so that it can be removed only by a blow on the hook end.

Both clamp and spring are heat treated to eliminate danger of breaking the parts. The form of the U-shaped clamp, moreover, is such that the vital portion of the spring is protected against abnormal abuse as might occur in case of derailments. The clamp itself projects 2½ in. below the rail and affords five square inches of bearing surface against the tie. Slipping along the rail is prevented by the tightness with which the clamp is held by the spring and also by reason of the double arm construction of the clamp which pinches the rail when force is applied to one side. The clamp is equally effective in either direction.

The same size of anchor which fits a 100-lb. A. S. C. E. section of rail will also function satisfactorily on 100-lb. R. A. or 100-lb. R. E. sections as well as a few others of similar section. The device is being distributed in Canada by Engineering Materials, Ltd., Montreal, Que.

A New Stapling Tool for Use with Steel Fence Posts

A NEW TYPE of stapling tool has recently been put on the market to facilitate the fastening of staples and clips in connection with the erection of fencing on steel fence posts. It can also be used for a number of other purposes in connection with fencing work such as splicing wire, taking up slack, and bolting up braces at end and corner posts. The tool is a drop forging approximately 8 in. long and ¼ in. thick with a square hole at one end and small recesses or jaws at the other. It also



Details of the Tool

contains two small holes in the body of the tool for use in splicing.

The recesses on each side of the tool act as jaws which grip the staple or clip and as the pressure is put on the tool, bend over the staple or clip, pulling it up tightly and firmly against the post. With the ordinary type of

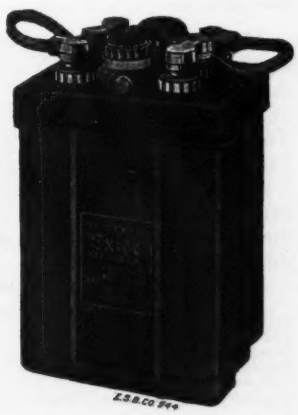
staple and slotted fence post, only two motions are needed, one for each leg of the staple, to draw up the fence wire and clinch the staple. Where studded fence posts are used, one motion of the tool draws up the clip and bends it tightly around the web of the post. It is stated that clips for this purpose should be preferably from ½ in. to ⅝ in. longer when the stapling-tool is used. Slack wire is taken up by using the tool in a manner similar to stapling. The square hole permits the use of the tool in place of a monkey wrench or similar tool in assembling and bolting up braces at end and corner posts.

The use of this tool has been found to speed up the work of fence gangs by decreasing the time necessary to clinch or bend over staples and clips as is shown by the results obtained in seven similar fence erecting operations. On one stretch, where the tool was used on part of the work only, the labor cost per rod was $1.04 and the rate of progress, 56.4 ft. per man per day. On three stretches where the tool was not used the costs and rates of progress were, respectively, $1.25, $1.15, $1.21, and 45.8 ft., 47.3 ft., and 47.1 ft. On the remaining three stretches and using the tool, the same figures were, respectively, $0.865, $0.865, and $0.79 and 67.1 ft., 59.2 ft., and 65 ft.

The new stapling tool was originated and developed and is being sold by F. H. C. Graves, assistant supervisor of track, Boston & Albany, Springfield, Mass.

A New Storage Battery for Railway Motor Cars

THE question of the suitability of storage batteries for use on railway motor cars has recently been brought to the front by the announcement of one of the storage battery manufacturers of its development of a battery of this type for this service. The new battery is the Exide motor car battery Type 3-KZ-3 which the manufacturer, the Electric Storage Battery Company, Philadelphia, Pa., claims adequately meets the demands for a dependable and economical source of current available for both lighting and ignition on all types of rail motor cars.



The Exide Motor Car Battery

The battery is 3½ in. long, 4½ in. wide, and 6¾ in. high and weighs 8¾ lbs. when ready for use. It is built up as one unit with a three-compartment hard rubber case specially reinforced for the demands of motor car service and containing thick heavy plates and wood and rubber separators to insure long life. A quarter turn of the plug through which the battery is filled locks it securely in place and makes it impossible for the solution to splash out over the battery in the case, a feature which is highly important. With a capacity of 6 volts and 11 amp. hours, the battery will furnish a hot spark for weeks on one charge for ignition purposes while it is equally suited to furnish at the same time light for headlights or for inspection lights. Where energy is required for lighting purposes, or for operating sirens or similar equipment, more frequent charging of course is required.

With the Associations

Metropolitan Track Supervisors' Club

The regular meeting of the Metropolitan Track Supervisors' Club was held at the Hotel Martinique, New York, on August 9 and was preceded by the usual luncheon. The Committee on Grade Crossing Protection under the chairmanship of J. E. Zullinger, supervisor, Pennsylvania System, West Philadelphia, Pa., presented its report on this subject. A feature of the meeting was the presentation of a large radio set by the association to W. C. Kidd, secretary-treasurer, as a mark of its appreciation of his work in behalf of the association since its organization in May, 1921.

Wood Preservers' Association

On account of a conflict with the automobile show and the congestion in the hotels resulting therefrom, the date for the annual convention has been changed to February 3-5, inclusive, and the Congress hotel has been selected as headquarters. The National Association of Railroad Tie Producers has also postponed its meeting for the same reason and will convene at the Congress hotel on February 5 and 6. All committees of the Wood Preservers' Association have been requested to complete and forward their reports to the secretary by October 1, in order that they may be printed and distributed to the members in advance of the convention.

Roadmasters' Association

All indications point to a large attendance at the annual convention which will be held at the Commodore hotel, New York, on September 16-18, the program for which was printed in the August issue. Requests for reservations on the special train which will leave Chicago over the New York Central at 4:00 p. m. (Central standard time) on Sunday, September 14, are coming in rapidly. It is expected that this train will make a number of short stops en route on Monday to enable those on the train to observe the construction on the four track main line east of Buffalo, thus adding to the educational value of the trip.

Since the program was published it has been amplified by the addition of two papers. E. Keough, assistant engineer maintenance of way of the Canadian Pacific will describe the rail laying methods in effect on that road and F. W. Hillman, division engineer, Chicago & North Western, Chicago, will speak on the roadmaster's responsibility in grade crossing protection.

In addition to the 51 firms which were noted in the August issue as having arranged for space in the exhibit of the Track Supply Association, which will be presented simultaneously with the Roadmasters' convention in the main ballroom of the hotel adjacent to the convention room, six additional firms since have taken

space, indicating that the exhibit will be the largest in the history of the association. Those firms which have arranged for space since the August issue went to press include the following:

Air Reduction Sales Company, New York,
Brown Rail Loader Company, Boston, Mass.
Carbic Manufacturing Company, Duluth, Minn.,
Grip Nut Company, Chicago,
Kentucky Rock Asphalt Company, Louisville, Ky.,
Rapid Drainage Pipe Corporation, New York.

In addition, the following firms have taken membership in the Track Supply Association without exhibits:

Morden Frog & Crossing Works, Chicago,
National Malleable & Steel Castings Company, Cleveland, Ohio,
St. Louis Frog & Switch Company, St. Louis, Mo.,
Pettibone-Mulliken Company, Chicago,
Mechanical Manufacturing Company, Chicago,
Cleveland Frog & Crossing Company, Cleveland, Ohio,
James C. Barr, Boston, Mass.

Bridge and Building Association

Arrangements are nearing completion for the thirty-fourth annual convention which will be held at the Baltimore hotel, Kansas City, Mo., on October 21-23. The Atchison, Topeka & Santa Fe will provide a special train for the members from Chicago and points east. This train will leave Chicago at 8:30 on Monday morning, October 20, stopping at a number of points of interest to bridge and building men en route and arriving at Kansas City at 7:30 that evening. The program as tentatively arranged is as follows:

Tuesday, October 21

Convention called to order at 10:00 o'clock.
Address of Welcome by J. F. Holden, vice-president, Kansas City Southern, Kansas City, Mo.
Address of President.
Report of Secretary-Treasurer.
Appointment of Special Committees.
Report of Committee on Smoke Jacks for Roundhouses and Other Railroad Buildings, Maro Johnson (I. C.), chairman.

Tuesday Afternoon.

Report of Committee on the Maintenance of Water Stations, O. C. Anderson (S. P.), chairman.
Paper: The Inspection of Bridges, A. F. Robinson, bridge engineer, A. T. & S. F., Chicago.
Report of Committee on Relative Merits of Different Kinds of Roofing Materials for Various Types of Buildings, R. E. Caudle (I-G. N.), chairman.

Tuesday Evening.

Paper: The Fire Hazard of Treated Timber, C. S. Heritage, bridge engineer (K. C. S.),Kansas City, Mo.

Wednesday Morning, October 22.

Report of Committee on Economical Methods of Handling Minor Jobs of Maintenance Work, T. G. Sughrue (B. & M.), chairman.
Report of Committee on Reduction of Accidents to Employees, D. Rounseville (C. & N. W.), chairman.

Wednesday Afternoon.

Report of Committee on Placing Concrete in Winter, F. P. Gutelius (D. & H.), chairman.
Address: The Bridge Work on the Kansas City Terminals, J. V. Hanna, chief engineer, Kansas City Terminal railway, Kansas City, Mo.

Wednesday Evening.

Annual dinner of the American Railway Bridge and Building Association, and the Bridge and Building Supplymen's Association.

Thursday, October 23.

Report of Committee on Inspection of Painting, Martin Kane (D. & H.), chairman.
Closing Business.

Thursday Afternoon.

Inspection Trip Over Kansas City Terminals.

The Material Market

WHILE a review of the material market conditions during the last month discloses further depressions in price, these changes have been less marked in character than for several months past and on the whole the market shows a more active tone. The production in the steel industry is now approximately 55 per cent of capacity, representing no marked change from previous months. Orders on the books of the United States Steel Corporation aggregated a smaller total on July 31 than at the end of the previous month or 3,187,072 tons, but the decrease, 75,433 tons, represents the smallest change in the total that has occurred during any month of the present year. Following is a table of iron and steel prices covering items concerning the maintenance of way department:

PRICES PER 100 POUNDS

	July		August	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$2.90	$3.10	$2.80	$2.80 to $3.00
Track bolts	$3.75 to 4.00	4.10	3.75	3.80 to 4.00
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.50 to 2.55	2.60	2.50	2.45
Boat spikes	3.25 to 3.40	3.59 to 3.74	3.25	3.59
Plain wire	2.60	2.99	2.55	2.89
Wire nails	2.85	3.19	2.80	3.14
Barbed wire, galv.	3.60	3.94	3.50	3.84
C. I. pipe, 6 in. to 12 in., per ton		55.20		53.20
Plates	2.15	2.25 to 2.35	1.90 to 2.00	2.00 to 2.15
Shapes	2.15	2.25 to 2.35	2.00 to 2.15	2.10 to 2.15
Bars, soft steel	2.15	2.15 to 2.25	2.10 to 2.15	2.10 to 2.15
Rivets, structural	2.60		2.60	
Open hearth rails, per gross ton, f. o. b. mills				$43.00

Prices in the scrap market show an upward trend as indicated by the following table:

PRICES PER GROSS TON AT CHICAGO

	July	August
Relaying rails	$27.00 to $32.00	$27.00 to $32.00
Rails for rerolling	15.50 to 16.00	16.00 to 16.50
Rails less than 3 ft. long	17.00 to 17.50	17.50 to 18.00
Frogs and switches cut apart	15.50 to 16.00	15.50 to 16.00
Steel angle bars	16.00 to 16.50	17.00 to 17.50

Although there was a marked reduction in buying by retail lumber dealers late in August, the market during the greater part of August and the latter part of July manifested greater interest on the part of the buyers. This is indicated by statistics issued by the Southern Pine Manufacturers' Association and the West Coast Lumbermen's Association. Current prices for the lumber items appearing below show some flutctuation from the previous month, which are generally in the upward direction.

SOUTHERN PINE MILL PRICES

	July	August
Flooring, 1x4, B and B flat	$39.75	$42.00
Boards, 1x8, No. 1	32.20	33.20
Dimension, 2x4, 16, No. 1, common	27.55	26.20
Dimension, 2x10, 16, No. 1, common	25.30	26.80
Timbers, 4x4 to 8x8, No. 1	25.40	25.70
Timbers, 3x12 to 12x12, rough	34.80	32.95

DOUGLAS FIR MILL PRICES

	July	August
Flooring, 1x4, No. 2, clear flat		$30.00
Boards, 1x8, 6 to 20, No. 1, common	$15.50	16.50
Dimension, 2x4, 16, No. 1, common	15.50	16.50
Dimension, 2x10, 16, No. 1, common	15.00	16.00
Timbers, 6x6 to 8x8, No. 1, common	23.00	23.00
Timbers, 10x10 to 12x12, rough	17.00	18.00

The production of Portland cement for July, 1924, was 14,029,000 barrels, the largest in the history of the industry. For the first seven months of 1924, the production was 80,816,000 barrels as compared with 75,351,000 barrels for the corresponding period of 1923. In the table of prices per barrel given below, which are for carload lots, not including package, only a few changes from those given last month are recorded.

New York	$2.15	Minneapolis	$2.42
Pittsburgh	2.19	Kansas City	2.82
Atlanta	2.35	Dallas	2.05
Chicago	2.20	Denver	2.84
Cincinnati	2.52	San Francisco	2.61

News of the Month

The Pennsylvania has greatly extended its motor truck service for the handling of local freight over routes formerly served entirely by regular local freight trains and now uses 40 motor trucks in this service. These motor trucks cover routes each day aggregating a total of 1,412 miles or more than double the mileage over which they operated last spring.

Employees of the Baltimore & Ohio with their families, enough to fill 5 trains of 12 coaches each, picnicked on Sunday, August 10, at Willow Grove, Pa., on the Northeast Pennsylvania division of the Reading, 16 miles north of Philadelphia. The picnic was managed by the Baltimore & Ohio Railroad Veterans' Association.

The revenue freight cars loaded the week ending August 2 totaled 945,731, the largest loading for any week this year. While the loading for the week ending August 9 was 3,533 cars less than the total for the preceding week or 942,198 cars, the record for that week has been exceeded only twice during the present year, namely, for the week ending August 2 and the week ending on March 1.

The pilot trucks of all five of the locomotives of the Alberta & Great Waterways in western Canada have been equipped with steam pipes which eject steam under pressure and clear the rails of caterpillars. The swarms of caterpillars cross the tracks in such numbers that when crushed the rails become slippery, rendering the operation of trains unsafe and at times impossible.

An unusually heavy rainfall for this time of the year, accompanied by severe storms, gave the railroads a great deal of trouble during the month of August. The most pronounced difficulties occurred following storms in the latter part of the week of March 3 and during the week of March 17, particularly in Wisconsin, central and western Illinois and Iowa. Washouts interrupted service on many lines in these states.

The freight traffic on the railroads of the United States for the first six months of 1924 was more than 9 per cent below that for the corresponding period of 1923, according to statistics issued by the Bureau of Railway Economics, Washington, D. C. The net ton miles amounted to 204,636,000,000 or 20,850,000,000 below the corresponding figure last year. The average daily movement per freight car for the month of June, 1924, was 25.2 miles or 3.1 miles below the daily average for June, 1923.

Four persons were killed on August 21 when a passenger train of the Philadelphia & Reading was derailed as the consequence of striking a motor truck at a highway grade crossing at Cranford, N. J. In addition to two men riding on the truck the persons killed included the fireman on the passenger train and one passenger. Ten persons on the train were injured. The accident occurred because the driver of the motor truck endeavored to pass over the crossing while the signal bell was ringing. The view was clear and the train could be seen for a long distance.

On August 1 the Western Pacific and the Southern Pacific commenced the use of their parallel single track lines for the distance of 178 miles between Alazon, Nev., and Weso, as joint double track. This is the result of an agreement between the two railways effected early in the present year for the use of their tracks as paired track for a period of 50 years. The tracks of the Western Pacific were placed in condition for the greatly increased traffic in a period of four months during which 200,000 cu. yd. of material was placed in widened banks, 300,000 cu. yd. of ballast was applied and 1,170,000 tie plates were inserted. The working force engaged in this work averaged approximately 1,400 men and was at times as high as 1,700 men.

The operating revenues of the Class I railroads in the United States for the first six months of 1924 were $2,871,752,765 as compared with $3,098,753,735 for the corresponding period of 1923. The operating expenses for the first six months of the two years were $2,273,832,920 and $2,445,620,047 respectively, while the net railway operating incomes were $390,982,857 and $446,847,186 respectively. Although the total operating expenses for the first six months of 1924 were less than for the corresponding period in 1923, the maintenance of way expenses were larger, the total for the first six months of 1924 being $382,587,332 as compared with $375,736,896 for the first half of 1923. This increase of 1924 over 1923 was due to heavier expenses in the early part of the present year, since the expenditures for maintenance of way and structures for June, 1924, were only $71,461,591 as compared with $77,220,208 for June, 1923.

The first annual track meet of the New York Central Lines will be held on the grounds of the West Technical High school at Cleveland, Ohio, on Saturday, September 20, and plans are being made for an elaborate program. The general chairman is Colonel H. W. Taylor, 466 Lexington Avenue, New York City. The expense for this outing will be met by the sale of admission tickets at 50 cents each instead of endeavoring to procure the money in other ways such as the sale of advertising for the official program, etc. The tickets will be put on sale all over the New York Central

The Interstate Commerce Commission, following an investigation of railway air brakes on the petition of the Automatic Straight Air Brake Company, has issued an opinion on this subject which embodies a number of conclusions. Among the most important of these is a recommendation that power brake systems on trains should provide means whereby an effective emergency brake cylinder pressure will be obtained following a full service application and following release after a full service application. The Commission announced that it would give further consideration to this matter pending the issuance of a formal order. In a dissenting opinion Commissioner McManamy stated that better maintenance of braking equipment was more certain to increase safety than any suggested improvements in the design of the equipment.

National Railway Appliances Association to Have More Space

The National Railway Appliances Association has arranged with the Coliseum Company, Chicago, for additional space 105 ft. by 172 ft. in area immediately north of the present building for its exhibit next March. The Coliseum Company will build a new structure on this property with spacious doorways connecting with the main exhibit hall, which will add approximately 18,000 sq. ft. of floor space for exhibition purposes. This space will tend to relieve much of the congestion which has prevailed in recent years and will enable the association to more nearly meet all of the demands for space. Floor plans and other information pertaining to the exhibit have been mailed to exhibiting members of the association, and space will be assigned at a meeting of the board of directors in November.

Personal Mention

General

G. D. Brooke, superintendent of transportation of the Baltimore & Ohio lines west, with headquarters at Cincinnati, Ohio, and a maintenance officer by training, has been appointed assistant to the vice-president of operation of the Chesapeake & Ohio, with headquarters at Richmond, Va., effective August 1. He was born on September 15, 1878, at Sutherlin, Va., and graduated from Virginia Military Institute in 1900. He entered railway service on July 17, 1902, as a rodman on the Baltimore & Ohio. From August, 1902, to December, he was a levelman and from December, 1902, to May, 1904, he was a transitman. On the latter date he was promoted to assistant engineer in charge of a field party, which position he held until March, 1905, when he was made assistant engineer in charge of location surveys at Cumberland, Md. In July, 1908, he was promoted to assistant division engineer, with headquarters at Pittsburgh, Pa., which position he held until July, 1909, when he was made division engineer, with headquarters at Baltimore, Md. From March, 1911, to February, 1912, he was assistant engineer in the operating department and in February, 1912, he was appointed assistant superintendent at Keyser, W. Va., since which time he has been in the operating department, having been superintendent of transportation of the Western lines at Cincinnati, Ohio, since March, 1919.

G. D. Brooke

H. O. Kelley, division engineer on the Peru division of the Wabash, with headquarters at Peru, Ind., has been appointed general manager of the Toledo & Western, with headquarters at Sylvania, Ohio.

Engineering

W. J. Harris, division engineer of the Chicago, Burlington & Quincy, has also been appointed engineer maintenance of way of the La Crosse division, with headquarters at La Crosse, Wis.

M. J. McDonough has been appointed division engineer of the Pennsylvania division of the Delaware & Hudson, with headquarters at Carbondale, Pa., succeeding H. S. Rogers, resigned.

J. H. Reeder, division engineer on the Canadian Pacific with headquarters at Montreal, Canada, has been promoted to assistant district engineer with the same headquarters, succeeding **G. H. Davis**, transferred to Toronto. **J. R. Caswell**, division engineer with headquarters at Sudbury, Ont., has been transferred to Smith Falls to succeed **J. H. Forbes**, transferred to Montreal succeeding Mr. Reeder.

J. T. Vitt, division engineer of the Western division of the Wabash, with headquarters at Moberly, Mo., has been transferred to the Peru division, with headquarters at Peru, Ind., succeeding **H. O. Kelley**, whose promotion to general manager of the Toledo & Western is reported elsewhere in these columns. **H. N. Huntsman**, division engineer on the St. Louis Terminal division, with headquarters at St. Louis, Mo., has been transferred to the Western division, with headquarters at Moberly, Mo., succeeding Mr. Vitt. **F. C. Huntsman**, first assistant engineer on the Moberly division, with headquarters at Moberly, Mo., has been promoted to division engineer on the St. Louis Terminal division, with headquarters at St. Louis, Mo., succeeding H. N. Huntsman. **F. B. Porter**, assistant engineer, with headquarters at Decatur, Ill., has been promoted to first assistant engineer on the Moberly division, succeeding F. C. Huntsman. **B. S. Walker** has been appointed assistant engineer on the Decatur division, succeeding Mr. Porter.

C. S. Robinson, whose promotion to engineer maintenance of way on the Maine Central, with headquarters at Portland, Me., was noted in the August issue, was born on April 10, 1887, at Portland, Me. He received his education at the University of Maine and entered the service of the Maine Central in 1909 as a rodman. In October, 1912, he was made assistant engineer and in August, 1913, was made chief clerk in the office of the engineer maintenance of way. Mr. Robinson served in the engineering corps of the United States Army during part of 1918, and in December, 1918, returned to the service of the Maine Central as general supervisor maintenance of way, which position he held until his recent promotion.

Track

A. Thompson has been appointed roadmaster on the Union Pacific at Caliente, Nev., to succeed **G. H. Lonergan**, resigned.

Andrew Scott has been appointed roadmaster on the Union Pacific, with headquarters at Spokane, Wash., to succeed **S. M. Hickson**, resigned.

J. E. Holmes has been appointed acting roadmaster of the Seward-Anchorage division of the Alaska Railroad, with headquarters at Tunnel, Alaska, in the place of **George W. Colwell**, who has been granted a leave of absence.

J. M. Fair, supervisor of track in the general offices of the Pennsylvania at Philadelphia, Pa., has been transferred to the Cumberland Valley division with headquarters at Chambersburg, Pa., succeeding **F. D. Cooner**, resigned.

A. C. Haines, extra gang foreman, has been promoted to supervisor of the T. L. & N. branch of the Cincinnati division of the Pennsylvania System, Southwestern region, succeeding **J. J. Guilday** who has been retired on a pension.

S. F. Carper has been promoted to track supervisor on the Southern railway, with headquarters at Rome, Ga., succeeding J. T. Moon, whose promotion to roadmaster was reported in the August issue.

John H. Broome, whose promotion to supervisor of track on the Louisville & Nashville, with headquarters at Selma, Ala., was reported in the August issue, was born near Thomasville, Ga., on February 18, 1872. He entered railway service as a section laborer in November, 1896. He was promoted to apprentice foreman in the spring of 1898 and on June 1, 1899, was promoted to section foreman. He left the service of the Louisville & Nashville in September, 1905, returning in 1907 as a section foreman, which position he held until his recent promotion.

Michael Sullivan, whose promotion to supervisor of track on the New York, New Haven & Hartford, with headquarters at Providence, R. I., was announced in the August issue, was born on September 2, 1888. He entered railroad service as a laborer on the New York, New Haven & Hartford on April 27, 1905, and was promoted to acting foreman on September 4, 1908. He was made section foreman on July 11, 1911, which position he held until November 1, 1921, when he was promoted to assistant track supervisor, which position he was holding at the time of his recent promotion.

C. B. Hoyt, superintendent of track, maintenance and construction of the Nickel Plate district of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has retired on account of ill health and the office has been abolished. **F. S. Hales** has been appointed engineer of track, with headquarters at Cleveland, Ohio, a newly created position. Mr. Hoyt was born on February 12, 1860, at Adrian, Mich., and entered railway service in 1888 as a roadmaster's clerk on the Lake Shore & Michigan Southern, now a part of the New York Central. In 1893 he was promoted to roadmaster of the Ft. Wayne division and he was later

transferred to the Coldwater division. Mr. Hoyt was appointed chief supervisor of track of the New York, Chicago & St. Louis in August, 1898, and held this position until October, 1905, when he was promoted to trainmaster of the Western division. He was promoted to superintendent of track, maintenance and construction in August, 1907, and remained in that position until his retirement.

John Esse, whose promotion to roadmaster on the Union Pacific, with headquarters at Evanston, Wyo., was noted in the August issue, was born on October 14, 1876, at Wells, Minn. He entered railway service in 1900 as a section hand on the Chicago, Milwaukee & St. Paul. In 1901 he became section foreman on the Chicago, Rock Island & Pacific, and in 1909 was promoted to roadmaster. He left this road in 1910 and became supervisor on the Kansas City Terminal, leaving this road in the spring of 1911 to become an extra gang foreman on the Union Pacific. Since that time he has held consecutively the positions of section foreman, extra gang foreman, work train foreman, steel gang foreman, gravel pit foreman, general foreman and acting roadmaster, which last position he was holding at the time of his recent promotion.

A. Jung, roadmaster on the Nebraska division of the Union Pacific, with headquarters at Grand Island, Neb., was promoted to general roadmaster of the Kansas division, with headquarters at Kansas City, Mo., on June 1, vice **L. J. Overman,** who was transferred to the Western division, with headquarters at Green River, Wyo., to succeed **O. C. Wilkes,** transferred to the Wyoming division, with headquarters at Cheyenne, Wyo., succeeding **J. A. Ottman,** pensioned. **H. E. Martens,** roadmaster with headquarters at Fremont, Neb., was transferred to Omaha, Neb., vice **J. R. Bitney,** transferred to Grand Island, Neb., to succeed Mr. Jung. **G. H. Warfel,** roadmaster with headquarters at Kearney, was transferred to Fremont to take the place of Mr. Martens. **W. A. Davidson,** roadmaster with headquarters at Columbus, Neb., was transferred to Kearney to succeed Mr. Warfel. **Ed Bennetsen** was promoted to roadmaster with headquarters at Columbus to take the place vacated by Mr. Davidson.

Bridge and Building

P. Swenson, superintendent of bridges and buildings on the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn., has retired.

Thomas Thygeson, whose promotion to master carpenter on the Great Northern, with headquarters at Grand Forks, N. D., was reported in the July issue, was born on March 27, 1872, at Fergus Falls, Minn. He entered railway service on the Great Northern as a carpenter's helper and was promoted to carpenter in 1898, which position he held until 1902, when he was promoted to foreman. In 1918 he was promoted to master carpenter on the Northern division, which position he held until the Northern division and the Dakota division were consolidated, when he was made assistant master carpenter. He held this position until June, 1924, when he was again promoted to master carpenter.

John H. Johnson, whose promotion to master carpenter on the Central region of the Pennsylvania System, with headquarters at Cleveland, Ohio, was recorded in the August issue, was born at Boston, Ohio, on November 4, 1866. He entered the service of the Pennsylvania as a carpenter on May 26, 1892, and eight years later, on July 6, 1900, was promoted to carpenter foreman. On July 1, 1921, he was promoted to assistant master carpenter and served in this position until February 11, 1924, when he was appointed acting master carpenter, and was serving in that position on June 16, when he was definitely promoted to the position of master carpenter.

Purchases and Stores

R. J. Elliott, purchasing agent of the Northern Pacific, with headquarters at St. Paul, Minn., has been placed in charge of the purchasing and stores department to succeed **F. G. Prest,** director of purchases, who has retired under the pension rules after 44 years of continuous service with this company. **L. Crassweller,** assistant purchasing agent, with headquarters at Seattle, Wash., has been transferred to St. Paul, Minn., and will be succeeded by **Paul McKay** as assistant purchasing agent.

J. H. Lauderdale has been appointed general purchasing agent of the International-Great Northern, with headquarters at Houston, Tex., to succeed C. B. Porter, resigned.

Edmund T. Burnett, who retired as general purchasing agent of the Norfolk & Western at Roanoke, Va., on December 31, 1920, died at a hotel in New York on July 14 following a short illness.

J. P. Kavanagh, general storekeeper of the Chesapeake & Ohio, with headquarters at Huntington, W. Va., has had his jurisdiction extended over the entire system of the Chesapeake & Ohio, with the same headquarters. **W. L. Monning,** assistant to the superintendent of stores, with headquarters at Huntington, has been appointed assistant to the general storekeeper, with the same headquarters, the position of assistant to the superintendent of stores having been abolished. **John Thomson** has been appointed chief stores accountant, with headquarters at Huntington. **E. R. Brinton,** general storekeeper at Covington, Ky., has been appointed assistant general storekeeper, with the same headquarters and **A. H. Young, Jr.,** general storekeeper at Clifton Forge, Va., has been appointed assistant general storekeeper, with the same headquarters, the positions of general storekeeper of the Western and Eastern general divisions having been abolished.

Obituary

J. M. Bibb, formerly supervisor of bridges and buildings on the Louisville & Nashville, with headquarters at Birmingham, La., died in that city on June 15.

John H. Dunlap, secretary of the American Society of Civil Engineers, died on July 29, at Chicago, from injuries received in a railroad accident at Buda, Ill., on June 30, while returning from the annual convention of the society in Pasadena, Cal., on June 18 to 21. Mr. Dunlap was born at Harrisville, N. H., on September 9, 1882, and was graduated from the Thayer School of Civil Engineering at Dartmouth College in 1905. During 1905 and 1906 he was engaged in engineering work with the U. S. Reclamation Service in Nevada, following which he returned to college to further his engineering studies. He subsequently served in the engineering department of the Pennsylvania Railroad during the summer of 1907 and the following year as field instructor in surveying at the Thayer School. Following his final degree in 1908 he joined the faculty of the University of Iowa, where he was subsequently promoted to professor of hydraulics and sanitary engineering in the College of Applied Science. He was also engaged in consulting work in civil and sanitary engineering. Professor Dunlap was elected secretary of the American Society of Civil Engineers in June, 1922, to succeed to the office left vacant by the retirement of Charles Warren Hunt, in 1920.

J. H. Dunlap

Alvin E. Deal, bridge engineer of the Delaware, Lackawanna & Western, with headquarters at Hoboken, N. J., died on July 24. Mr. Deal was born at Green Island, N. Y., on December 24, 1860, and was graduated from Rensselaer Polytechnic Institute at Troy, N. Y., in 1882. From 1882 to 1885 he was engaged in various activities connected with bridge construction in the vicinity of Pittsburgh, Pa., entering rail-

way service in September of the latter year as an assistant engineer on the Delaware, Lackawanna & Western at Scranton, Pa., where he remained for the next four years. In October, 1889, he was promoted to assistant bridge engineer, with headquarters at Hoboken, N. J., serving in that capacity until February, 1903, when he was promoted to bridge engineer, with the same headquarters. Mr. Deal continued in the capacity of bridge engineer up to the time of his death, his entire railway service having been with the Delaware, Lackawanna & Western.

Francis Ingalls, formerly supervisor of bridges and buildings on the Dakota division of the Northern Pacific, with headquarters at Jamestown, N. D., died at St. Paul, Minn., on August 9. Mr. Ingalls retired from active railway service on August 1, 1923, after having served as supervisor at Jamestown for 41 years. He was a charter member of the American Railway Bridge and Building Association. A sketch of his railway career was published in the September, 1923, issue, page 375.

Edward Ford, assistant to the president of the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific, who died on August 13, received most of his early railway training in the construction and maintenance of way departments. He was born in July, 1862, at Kingston, Canada. After graduating from the Royal Military College of Canada, he entered railway service in July, 1881, in the construction department of the Canadian Pacific. He was promoted to assistant supervisor in 1883 and shortly afterwards was appointed a supervisor on the Pennsylvania. Mr. Ford was appointed roadmaster on the Central of Georgia in 1888 and four years later was appointed superintendent of the Florida Central & Peninsula. In 1895 he was appointed engineer of the Panama Railroad where he served until 1898, when he entered the service of the Alabama & Vicksburg as division superintendent. Mr. Ford was promoted to assistant of the president in 1907. He was also elected president of the Arkansas & Louisiana Missouri in December, 1915, which position he held until June, 1920, when he resumed his duties as assistant to the president of the Alabama & Vicksburg.

Equipment and Supplies

The Canadian National is inquiring for 10,000 tons of rail.

The Chicago, Rock Island & Pacific has ordered 5,000 tons of rails from the Illinois Steel Company.

The Cuba Railroad has given an order to the United States Steel Corporation for 3,000 tons of 75-lb. open hearth rail.

The Great Northern is inquiring for 3,500 tons of structural steel for an ore dock, also for 520 tons of structural steel for ore spouts. This road has given a contract to the American Bridge Company for 2,400 tons of bridge steel. An order for 5,000 tons of tie plates, 2,000 tons of splice bars, 10,000 kegs of spikes and 4,500 kegs of track bolts has been divided about equally between the Bethlehem Steel Company, the Illinois Steel Company and the Inland Steel Company.

The New York Central has purchased 600 tons of structural steel for a bridge from the McClintic-Marshall Company.

The Norfolk & Western has placed orders for 34,000 tons of 130-lb. rail with the Carnegie Steel Company and for 13,400 tons of 100-lb. rail with the Bethlehem Steel Company. This road is reported to have ordered 25,000 kegs of spikes from Jones & Laughlin Company.

The Southern has ordered 12,000 tons of rail from the Tennessee Coal, Iron & Railroad Company, and has ordered 700 tons of structural steel for bridges from the McClintic-Marshall Company.

The Southern Pacific has given an order to the Tennessee Coal, Iron & Railroad Company for 3,500 tons of rail.

The Texas & Pacific has placed an order for 10,000 tons of rail with the United States Steel Corporation.

The Union Pacific has ordered 570 tons of structural steel for a viaduct at Kansas City, Mo., from the American Bridge Company.

Construction News

The Appalachian & Western North Carolina is the name of the line which the state of North Carolina proposes to build from Taylorsville, N. C., to Mountain City, Tenn., or to some other point in the same vicinity. The governor of the state has appointed a special commission, which has applied to the Interstate Commerce Commission for a certificate authorizing construction. Funds for the construction are to be advanced by the state. Frank T. Miller, Greensboro, N. C., is chief engineer.

The Atchison, Topeka & Santa Fe has been ordered by the California Railroad Commission to construct a subway at Franklin canyon road near Christie, Cal., in Contra Costa county, at an estimated cost of $88,701, which will be shared equally by the county and the railroad.

This road, the Union Pacific, and the Los Angeles Railway Corporation, the county of Los Angeles and the city of Los Angeles have been ordered to proceed with the construction of a viaduct over Macy street, Los Angeles, Cal., by the Railroad Commission of California, following the approval of plans for this work.

This company has awarded a contract to F. M. Spencer & Son, Topeka, Kan., for the construction of a one-story shop building at Topeka, to cost approximately $40,000.

The Baltimore & Ohio is asking for bids for the installation of pipe lines and machinery for a water treating plant at Ottawa, Ohio, and has awarded a contract to the Chicago Bridge & Iron Works for building a water softening tank 32 ft. in diameter by 46 ft. high, to be erected at Bridgeport, Ohio, and for furnishing and erecting a 100,000-gal, elliptical bottom, all-steel locomotive service tank at Stone House Cove, Curtis Bay, Md.

The Canadian National has awarded contracts as follows for the grading of branch lines: Dunblane, Sask., to Dutton, to Mannix & Wickstrand, Winnipeg, Man.; Hanna, Alberta, to Worden to A. C. Bryson & Son and Boyds, Ltd., Winnipeg; Loverna, Sask., and Teebles South branch to J. T. Hargrave & Co., Winnipeg. The company closed bids on August 18 for the construction of a brick freight shed and offices at North Battleford, Sask., and a three stall brick addition to its round-house at Brandon, Sask.

The Canadian Pacific has awarded a contract to Stewart & Cameron, Winnipeg, Man., for the grading of a branch line from Amulet, Sask., to Dunkirk, a distance of 35 miles. This company has awarded a contract to W. A. Dutton, Winnipeg, for the grading of an extension from Consul, Sask., into the Frenchman River district.

This company has awarded a contract to Carter, Hall & Aldinger, Winnipeg, Man., for the construction of a 280 room extension to its hotel at Lake Louise, Alta.

The Central Railroad of New Jersey has awarded to the Chicago Bridge & Iron Works a contract for furnishing and erecting a 50,000-gal. elliptical bottom, all-steel locomotive service tank to be erected at Raritan, N. J.

The Chesapeake & Ohio is preparing plans for a 500,000-gal. steel water treating plant at Russell, Ky., to cost $65,000.

The Chicago, Burlington & Quincy and the Colorado & Southern have agreed to enlarge, improve and consolidate their freight yards at Denver, Colo., the work to cost about $300,000.

The Chicago, Milwaukee & St. Paul has purchased a tract of land between Highwood, Minn., and the Mississippi river, on which it is planned to locate shops, a roundhouse and a freight distribution yard.

The Chicago, Rock Island & Pacific, in conjunction with the Union Pacific, the Kansas City Terminal and the city commissioners, are planning the construction of a 3,000-ft. viaduct at Kansas City, Kan. The Rock Island is also making surveys for a new line between Trenton, Mo., and Kansas City, with a view to securing lower grades.

The Rock Island has asked the Interstate Commerce Commission for authority to construct an extension of the pro-

posed extension from Billings to Owens, Okla., pending in another proceeding. The projected extensions will constitute a continuous line from Billings, where the existing branch line now terminates, to Ponca City, Okla., the location of the Tonkawa oil field. The extension from Owens to Ponca City will be 20 miles in length.

The Chicago Union Station Company closed bids on Auguest 20 for the erection of train sheds. This company will soon accept bids on the construction of the Roosevelt Road viaduct, Chicago.

The Cleveland, Cincinnati, Chicago & St. Louis has awarded a contract to the Walsh Construction Company, Chicago, for the construction of an addition to its roundhouse at Sharonville, Ohio.

The Colorado, Columbus & Mexican has applied to the Interstate Commerce Commission for permission to construct 200 miles of line from Farmington, New Mex., to Grand Junction, Colo.

The Detroit & Ironton has been authorized by the Interstate Commerce Commission to construct a cut-off extending from a connection with the Detroit, Toledo & Ironton at Malinta, Ohio, to a connection with the Ironton, at Durban, Mich., a distance of approximately 55 miles. The cost of the line is estimated at $8,420,000, including the acquisition of the right-of-way.

The Erie has awarded a general contract to Bates & Rogers, Chicago, for the erection of a structual steel and brick powerhouse, 100 by 60 ft., at Jersey City, N. J., and to the Chicago Bridge & Iron Works for the furnishing and erection of a conical bottom steel tank of 50,000 gal. capacity at Johnsons, Ohio.

The Grand Trunk Western has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 500-ton concrete coaling station at Battle Creek, Mich.; a 350-ton concrete coaling station at Durand, Mich., and a 300-ton concrete coaling station at Grand Haven, Mich. This company closed bids on August 4 for the construction of a two-story brick office building and a one-story freight house at Port Huron, Mich., to cost approximately $75,000.

The Illinois Central has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a concrete viaduct incident to grade separation work at North Baton Rouge, La., to cost $75,000. This company will soon call for new bids for the construction of the line from Edgewood, Ill., to Fulton, Ky., a distance of 169 miles. Bids have been requested for the construction of a 600-ton concrete coaling station at Dawson Springs, Ky.

The Louisville & Nashville, which was reported in the August issue as asking for bids for the construction of a machine shop and a smith shop at Corbin, Ky., has awarded a contract for this work to Roehl & Corbin, Knoxville, Tenn. This company, reported in the August issue as preparing plans for the construction of a brick passenger station at Bowling Green, Ky., to cost approximately $200,000, is now asking for bids. This road will call for bids in November, for the construction of a building to be erected in conjunction with the enlargement of the Gentilly yards outside New Orleans, La., as reported in the Railway Age of July 26. All work in connection with this project, except the construction of buildings, will be carried out with company forces.

The Missouri Pacific has announced its intention to the Louisiana Public Service Commission to build a line from Epps in West Caroll Parish, Ark., to Eudora, a distance of 12 miles. This company has awarded a contract to the T. S. Leake Construction Company, Chicago, for the construction of a machine shop at Fort Scott, Kan. Plans have been prepared for the construction of a branch line from Little Rock, Ark., to the Arkansas state fair grounds at an approximate cost of $125,000.

The Motley County Railroad has applied to the Interstate Commerce Commission for permission to extend its line 125 miles, from Spur, Tex., to Memphis.

The Northern Pacific has awarded a contract to Charles Skooglund, St. Paul, Minn., for the construction of a reinforced concrete power plant and coal trestle at Brainerd, Minn. This company is constructing a 144-ft. by 190-ft. brick boiler and tank shop with 1, 70-ton and 1, 15-ton traveling crane at Livingston, Mont.

The Owensboro, Rockfort & Chicago has applied to the Interstate Commerce Commission for a certificate authorizing the construction of a line from Owensboro, Ky., to Elnora, Ind., 84 miles. E. T. Franks, Owensboro, Ky., president.

The Pennsylvania has awarded a contract to the Carmichael-Cryder Company, St. Louis, Mo., for the elimination of a grade crossing at Lafayette street, Fort Wayne, Ind., to cost approximately $75,000. The company has also awarded a contract to Milo R. Hauke, Cincinnati, Ohio, for the construction of a new freight station at Court street, in that city, to cost approximately $150,000. This company has also awarded a contract to Sinclair & Grigg, Philadelphia, for the erection of retaining walls and bridge abutments for track elevation between Arsenal bridge and Twenty-fifth and Reed streets, Philadelphia, to cost approximately $250,000. It is also planning the construction of a 29-stall enginehouse in East Toledo, Ohio, to cost approximately $500,000.

The Portland Terminal will reconstruct platforms and rearrange the tracks at its terminal freight house in Portland, Me. The work will cost approximately $103,000, and will be done by company forces.

The Richmond, Fredericksburg & Potomac will replace a 1,700-ft. wooden trestle over Quantico creek, with a steel viaduct. The steel, 1,500 tons, has been ordered from the American Bridge Company. The construction of the concrete substructure will be done by the company forces.

The St. Louis, Brownsville & Mexico has applied to the Interstate Commerce Commission for a certificate authorizing the construction of an extension from Lyford to Edinburg, Tex., 28 miles.

The St. Louis-San Francisco has prepared plans for a brick and concrete passenger station at Fayetteville, Ark., to cost approximately $100,000.

The St. Louis-Southwestern contemplates the erection of a brick station or Fordyce, Ark.

The San Benito & Rio Grande has applied to the Interstate Commerce Commission for a certificate authorizing the construction of an extension from Santa Maria to Monte Cristo, Tex., 30 miles.

The Sioux City Terminal is building a six-stall enginehouse and machine shop of reinforced concrete and brick construction, at an approximate cost of $100,000.

The Southern has awarded a contract to the Foundation Company for the design and construction of new locomotive repair shops at Atlanta, Ga. Construction will be started in a short time. It is estimated that it will take six months to finish the contract, and the total cost will be over $750,000.

The Tampico & Northern, of which Albert Steeves of San Antonio, Tex., is president, has been granted permission by the Mexican government to construct a standard-gage railroad from Tampico, Mex., to San Antonio, Tex., a distance of approximately 550 miles.

The Union Pacific has awarded a contract to the Utah Construction Company for the construction of a branch from Rogerson, Idaho, to Wells, Nev., a distance of approximately 100 miles.

The Virginian has awarded to the Chicago Bridge & Iron Works a contract for furnishing and erecting a 100,000-gal. tank on a 100-ft. tower at Sewalls Point, Va. It has also awarded contracts to Joseph E. Nelson & Sons, Chicago, for the construction of a freight and passenger station at Salem, Va.

The Wenatchee Southern has been authorized by the Interstate Commerce Commission to construct a line from Wenatchee, Wash., to Beverly Junction, a distance of 53 miles, and from Hanford to a connection with the Oregon-Washington about five miles west of Kennewick, a distance of 29 miles. This project will provide a continuous line along the west side of the Columbia river from Wenatchee to Kennewick, a distance of 132 miles, and will provide an additional outlet for the movement of apples from Wenatchee.

Supply Trade News

General

Fairbanks, Morse & Company, Chicago, contemplates the erection of a branch plant at Los Angeles, Cal., estimated to cost $1,000,000 with equipment.

The Inland Steel Company has opened a branch office in the Bank of Commerce building, Kansas City, Mo., and **O. G. Blake** has been made district sales manager.

The Massey Concrete Products Corporation, Chicago, has sold to the Westinghouse Electric & Manufacturing Company its entire interest in the manufacture and sale of Hollowspun concrete posts and poles, including its plant at Milwaukee. This department was confined to the Milwaukee plant exclusively and its sale in no way affects the activities of the Massey Company in its other twelve plants.

The McMyler Interstate Company, Cleveland, Ohio, has completed negotiations for the purchase of the **Industrial Works,** Bay City, Mich., manufacturers of wrecking and locomotive cranes, subject to the approval of the stockholders of both companies. At a special meeting of the stockholders on August 22, a plan was offered to increase the capital stock from 30,000 to 250,000 shares of no par value. The Bay City plant will be kept in operation as the unit of the company.

Personal

A. W. Dorsch, field superintendent of **S. F. Bowser & Co.,** with headquarters at Ft. Wayne, Ind., has resigned to engage in other work.

Theodore B. Counselman has been appointed western representative of the Clark Car Company, Pittsburgh, Pa., with offices at 122 South Michigan avenue, Chicago.

D. A. Tomlinson, manager of the Railways Bureau of the Portland Cement Association, with headquarters at Chicago, died on August 7, while playing tennis. He was born on April 17, 1890, at Detroit, Mich., and graduated from the Massachusetts Institute of Technology in 1912. He later took up special work at Armour Institute, Chicago. He entered railway service in June, 1912, with the Chicago & Western Indiana, in whose employ he remained for five years, during which he was assistant engineer, handling successively track elevation, yard construction, valuation and extensive studies of terminal facilities. He entered the United States Army in June, 1917, as a second lieutenant and was discharged in January, 1919, as a captain in the coast artillery corps. During his period of service he was adjutant to the constructing quartermaster at Camp Grant and instructor of orientation at the Officers' Training Camp and at the Coast Artillery School at Fort Monroe, Va. At the conclusion of the war he was appointed manager of the Central Zone Professional and Special Section of the United States Employment Service, Chicago, an organization of facilities for obtaining employment for returning soldiers and sailors, especially in the engineering field. From April, 1919, to February, 1920, he was assistant secretary of the American Association of Engineers at Chicago in charge of railroad and employment work. He entered the employ of the Portland Cement Association at Chicago in February, 1920, and in January, 1922, he was promoted to manager of the Railways Bureau, which position he held until the time of his death.

D. A. Tomlinson

B. W. Beyer, Jr., sales engineer of the Union Special Machine Company, Chicago, has been appointed district sales engineer of the **Industrial Works,** Bay City, Mich., with headquarters at New York.

Albert Swartz, who resigned as general manager of the Toledo & Western, with headquarters at Toledo, Ohio, has been appointed district sales agent of the Arcco Anti-Rail-Creeping Company, Inc., with headquarters at 1526 Manhattan building, Chicago.

F. E. Mills, general credit manager of the **Wayne Tank & Pump Company,** with headquarters at Ft. Wayne, Ind., has been appointed assistant treasurer, with the same headquarters. **C. L. McDavitt,** former European financial manager, with headquarters at Paris, France, has been appointed office manager, with headquarters at Ft. Wayne, Ind.

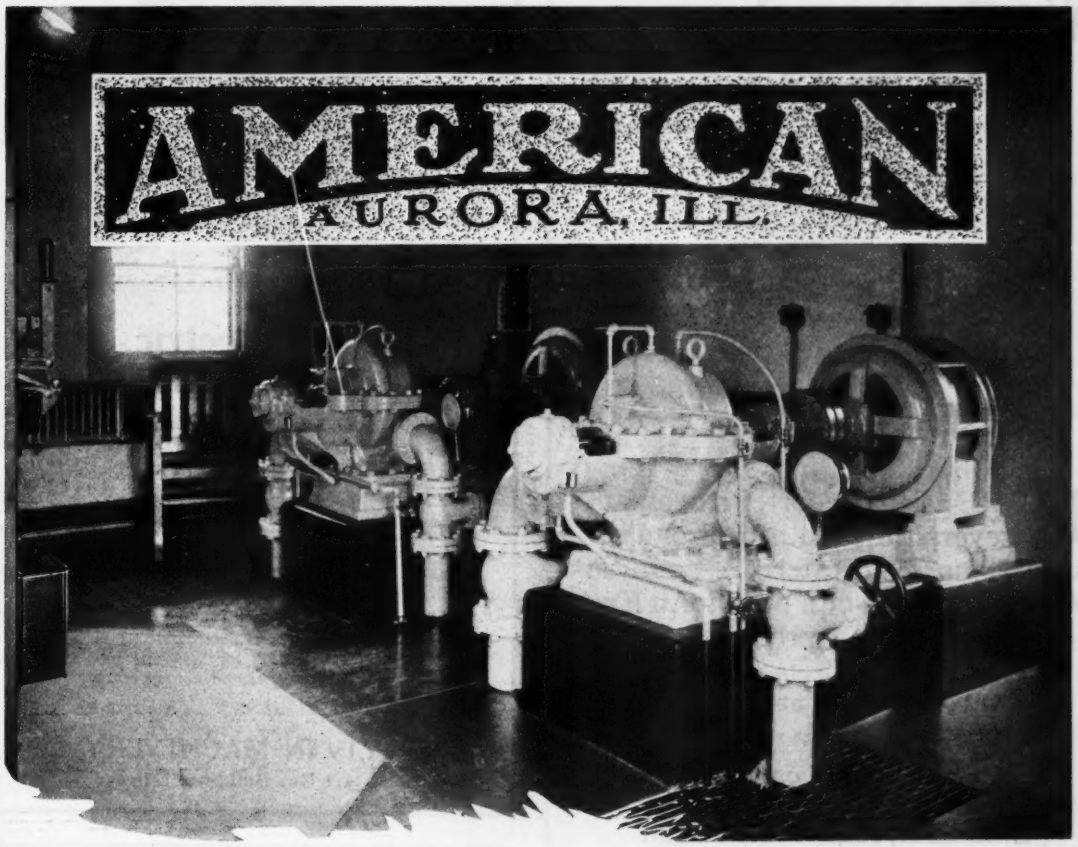
H. M. Richards has been appointed district manager of the **American Rolling Mill Company,** Middletown, Ohio, in charge of its Cleveland district office at 1408 B. F. Keith building. For a number of years Mr. Richards was located at the home offices, and in recent years, at the Pittsburgh district office. **J. T. Hagan,** of Cleveland, is associated with Mr. Richards in his new work.

A. C. Irwin, for several years engineer of the Structual bureau, Portland Cement Association, with headquarters at 111 West Washington street, Chicago, has been appointed manager of the Railways bureau succeeding **D. A. Tomlinson,** whose death is recorded elsewhere on this page. Mr. Irwin is a graduate of Ohio University in civil engineering, subsequently obtaining a higher degree at Cornell University where he was engaged for some time in teaching. His first railway experience was obtained on the Key West extension of the Florida East Coast, on which he was engaged in the design of the concrete arches for the long viaducts. After further service as an instructor in technical schools he became engineer of design on the Nickel Plate portion of the Cleveland Short Line grade separation and four-track construction work, which was carried out at Cleveland from 1909 to 1913. Following the completion of this work he entered the engineering department of the Chicago, Milwaukee & St. Paul at Chicago, where he was engaged in the design of bridges and other structures, continuing in this employment until 1917, when he joined the staff of the Portland Cement Association.

Trade Publications

A Small Wood Preserving Plant.—Grant B. Shipley, consulting engineer in timber preservation, Century building, Pittsburgh, Pa., has issued a four-page booklet describing the Shipley treating unit, a small but complete plant for the treatment of timber by the standard pressure processes, using any of the recognized preservatives. This plant is designed for use where the expenditure for a large plant is not warranted, but where the benefits of timber preservation are desired. This circular describes the plant and the manner of its operation.

Creosoted Yellow Pine Poles.—The International Creosoting & Construction Company, Galveston, Tex., has issued a 36 page booklet describing in detail the practices which it follows in the cutting, seasoning, framing and treatment of its southern yellow pine poles. This booklet contains an excellent exposition of the qualifications of this timber for pole line construction and describes the manner in which the cutting, seasoning and treatment of these poles are safeguarded to prevent deterioration of the timber. The booklet is illustrated profusely with photographs showing the various steps in the manufacture of International creosoted pine poles and concludes with the specifications for the poles and for their treatment. This booklet contains a large amount of information which will be valuable to every user of poles.



An Ideal Pumping Plant!

An ideal pumping plant is in operation on the H. McKay Twombley estate at Madison, New Jersey.

Two American Deep Well Power Heads, operating against a head of 135 ft., pump the water from the ground into a reservoir. These power heads have a stroke of 24".

Two American 4" two stage, centrifugal pumps, driven by sixty horse power electrical motors are used for fire protection and distribution purposes. They have a capacity of 500 gallons per minute, against a head of 125 ft., and are driven by sixty horse power motors at 1750 R. P. M.

American Well Works engineers, with their long experience in the design and specifications for pumping installations, are at your disposal.

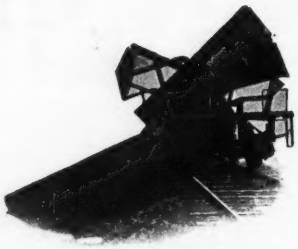
What does ***your*** water cost per gallon?

THE AMERICAN WELL WORKS

General Office and Works
AURORA, ILL.

Chicago Office
First National Bank Bldg

Western Dump Cars Lower the Cost Record



Western Air Dump Car with Apron

HERE is the report from one of several important railroad installations of Western Automatic Air Dump Cars equipped with Extension Floor or Apron.

Outfit valued at $3.00 per minute.

One hundred cars loaded per day in hard digging, two-mile haul, grade elimination work.

Lowest cost records ever obtained by this railroad, unit costs approximately 25% of the lowest costs obtainable using former methods with unloading plow.

Western Dump Car Facts

Unusual strength of trucks.

Few castings—easily accessible.

Dump beyond the ballast.

Apron works away from load—you can right your train without moving up.

Let us tell you where you can see these cars in operation and study their performance first hand. Write to-day.

Western That's Why

WESTERN WHEELED SCRAPER CO.

Founded 1877

Earth and Stone Handling Equipment

AURORA, ILLINOIS

Sullivan Single Drum Electric Portable Hoist

A New Electric Hoist

SULLIVAN engineers have designed a new portable hoist, electric motor driven. It is similar in power, size and adaptability to the Sullivan "Turbinair" Hoists which have become so popular, and both single and double drum models are available.

It's All in the Drum

Sullivan Electric Hoists have 6½ H. P. motor, mounted in a tight casing *inside the drum*. Reduction gears and bearings are enclosed and splash oiled. All you see is the drum and clutch and brake.

You can hoist a ton vertically on single line, or pull a 50-ton car on level track. The double drum hoist is compact and easy to handle for two-rope jobs such as rail handling, or boom derricks or car spotting.

Ask for new Bulletin No. 1976-E

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A TYPE FOR EVERY SERVICE

Bulletins on request.

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5
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1. **LOW COST.** Considerably less than a monolithic retaining wall.
2. **MINIMUM EXCAVATION.** Material excavated for each section can be used as back fill for the adjacent section.
3. **NO EQUIPMENT NECESSARY.** Units can be easily handled by two men.
4. **100% SALVAGE VALUE.** Equally applicable for temporary or permanent work.
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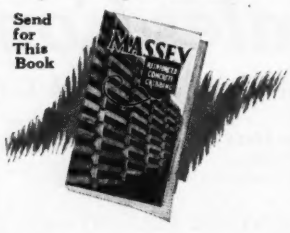

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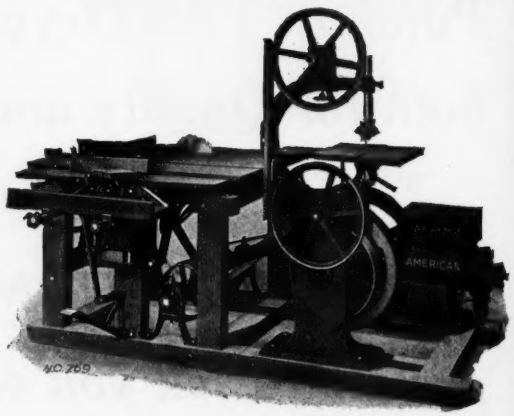
AMERICAN COST CUTTERS



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THE IDOL TRACK LINER AND JACK

Illustration No. 1

Illustration No. 2

Illustrations numbers 1 and 2 show the proper placement of Liners to line frogs. Place three Liners against outside rail in direction of throw, two Liners against frog and two Liners against inside rail. The work of lining can be done with one-third the number of men required when using lining bars. This work usually takes a greater period of time with 15 to 21 men using lining bars than is taken by 7 men when using Idol Track Liners.

Illustration No. 3

Illustration No. 4

Illustrations numbers 3 and 4 show the lining of ordinary track. Set two Liners against outside rail in direction to be lined, and one against inside rail.

Illustration number 3 shows three men doing the same work with Idol Track Liners as was formerly done by seven to nine men with lining bars. The seven men using lining bars shown in illustration number 4 could not line the track; the three men with Liners moved the same track easily, without digging out the ballast at the end of the ties. When section crews are reduced to three men, all ordinary track can be lined without waiting for the organization of full forces, and without the doubling of section crews.

Illustration No. 5

NOW IN USE ON 81 RAILROADS

THE IDOL TRACK JACK No. 1

Illustration No. 5 shows Idol Track Jack No. 1, which weighs only 26 pounds.

Illustration No. 6 shows man carrying Idol Track Jack, wrench, pick and shovel with ease.

Illustration No. 6

THE IDOL TRACK LINER CO.

Railway Labor Saving Devices

717-723 South Wells St., Chicago, Ill.

F. Hackmann, President and Mechanical Engineer **J. J. Franzen, Secretary and Treasurer**

Thos. D. Crowley & Co., General Sales Agents, Track Liner Division, Peoples Gas Building, Chicago

Hope E. Scott & Co., Ltd., Sole Canadian Representatives

The Baldwin Locomotive Works, Export Representatives

JORDAN SPREADER
"Does the Work of an Army of Men"
SNOW PLOW ICE CUTTER UNIVERSALLY STANDARD DITCHER
O. E. JORDAN COMPANY
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EAST CHICAGO, INDIANA

Few labor-saving and hence cost-cutting machines, excel the Jordan in their wide range of application, the weather conditions which they overcome, and the clean-cut way in which they perform.*

*Is there a JORDAN with attachments to help you attain lower operating and maintenance costs?

We make the smallest cast iron pipe in America—1¼, 2 and 3-inch. Use it where other pipe rusts. Get booklet R and prices.

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McWANE PRECALKED JOINT PIPE CAST IRON

There Must Be Something—

in the design and operation of the American Lime-Soda Water Softener to make twenty-five American Railroads prefer it.

There Is!

1. Absolute accuracy of apportioning the treating chemicals to the flow of the water.
2. Settling tanks of a capacity to give the retention period necessary to settle out the precipitated solids.
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4. Carefully designed sludge removal system with backwash attachment which insures the removal of sludge from settling tank with the least possible waste of water.

AMERICAN WATER SOFTENER COMPANY

Fairhill P. O. Philadelphia, Pa.

Specialists for twenty-two years in

RAILROAD WATER PURIFICATION

A POSITIVE Protection for the Right-a-Way

The design and construction of Q & C Derails embodies the most modern and effective method of derailing rolling stock for both high and low speeds.

They are made for portable, hand and mechanical service and furnished in left, right and double throws.

All models are adjustable with the exception of the portable types and these fit any T section of rail. The adjusting is accomplished by raising or lowering the pivot rod in a series of holes found in the brackets. This readily permits the use of one model over a wide range of rail heights and eliminates the necessity of carrying many sizes in stock and, also, confusion in the storehouse.

We also manufacture Q & C Switch and Target Stands for use with our derailing equipment.

Further information and prices on request.

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A Derail for Every Purpose

How many of your water columns are knocked down every year?

What does the repairs and maintenance—not the result of ordinary use—cost you?

Avoid this annoyance, trouble and expense by using a

How lateral movement of spout prevents column being knocked down

POAGE Style "H" WATER COLUMN with FENNER DROP SPOUT

The three foot lateral range in the Fenner spout and the steel riser in the Poage Style H save the water column from being knocked down by the shifting of the tender.

The tender has to leave the track to knock this column down.

The flexible spout makes it unnecessary to spot the tender accurately. You save time by quick adjustment.

The five foot up and down range enables the water column to fill a tender of any height.

The open telescopic joint does not waste a drop of water. It banishes the usual winter time troubles. Ice does not collect upon it.

The valve permits the maximum amount of water to flow in the shortest time. There is a minimum of frictional resistance. It shuts the water off quick without water hammer.

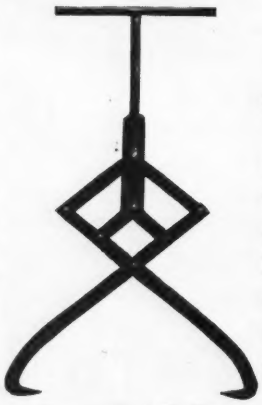
Try the Poage Style H column. You will find that it has remarkable operating advantages.

Manufactured Exclusively By

The American Valve & Meter Co.

Cincinnati, Ohio

One Man Tie Tong



Patented Davis Tie Tong

Chief Advantages Over Other Tongs:

Single handle feature assures even pressure of hooks; one man handling; unique construction, make this a safety tool for section workers.

Write for a sample of this Tong, put it in use with a gang and verify the foregoing through real service.

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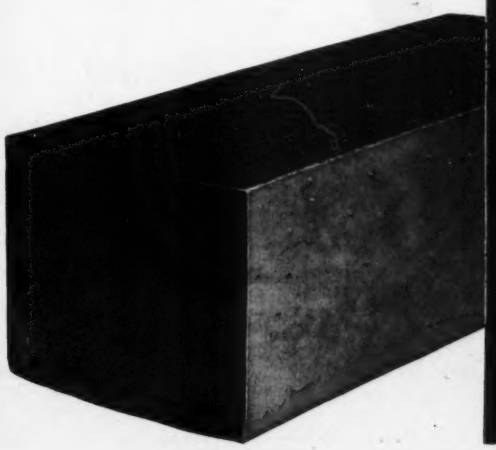
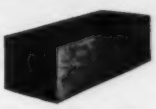
Brick
PAVEMENTS
OUTLAST THE BONDS



WHERE heavy trucks jolt and pound, — where draft-horses, delivering and taking away heavy loads, strain and lunge —where passengers, whose safety must be guarded by every precaution, hurry to their trains—these are the places where *only* vitrified brick makes the proper pavement.



Vitrified brick alone affords long and lasting service together with the skid-proof surface which safety demands.

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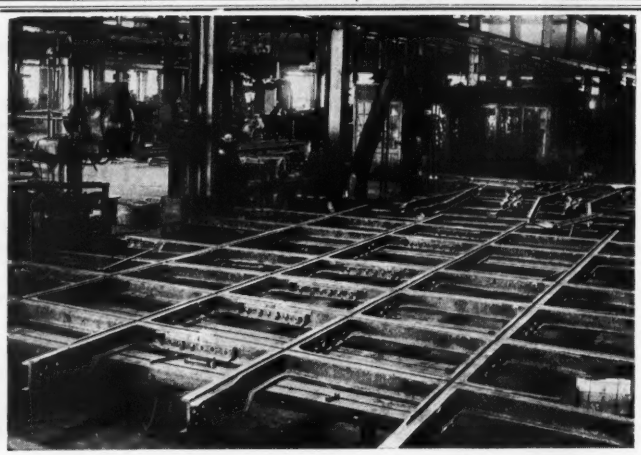

SECTION OF FABRICATING FLOOR SHOWING A SIX SOLID MANGANESE STEEL CROSSING JOB FOR AN EASTERN RAILROAD

Special Trackwork

For Steam and Electric Railroads in all types of construction.

The application of Manganese Steel for trackwork was originated by and developed by this company.

Maintenance Engineers are invited to submit their difficult or unusual problems to us; our facilities for the production of such work are unsurpassed.

WM. WHARTON, JR. & CO., Inc.,
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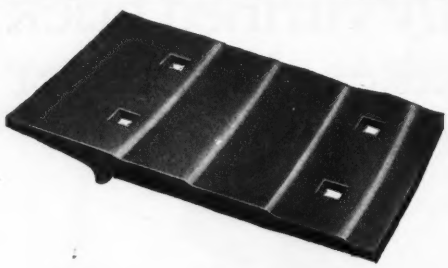

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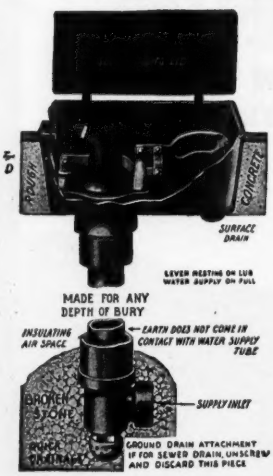
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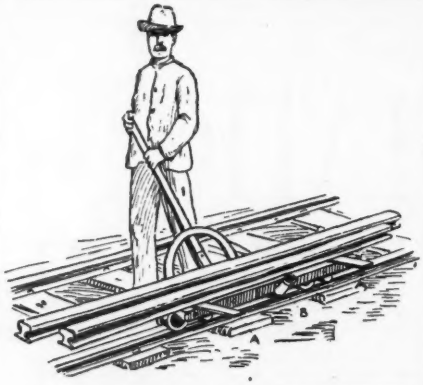

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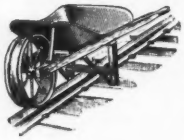

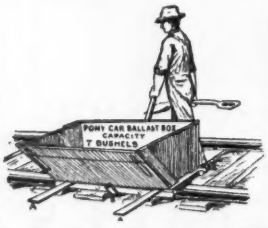

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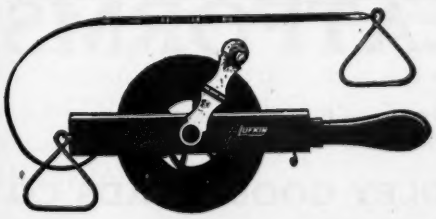

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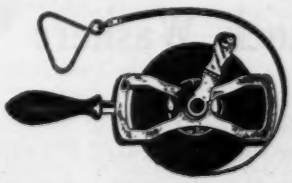

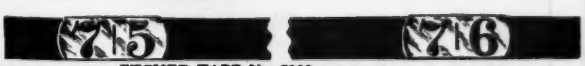

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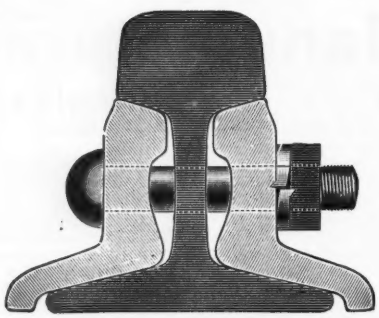

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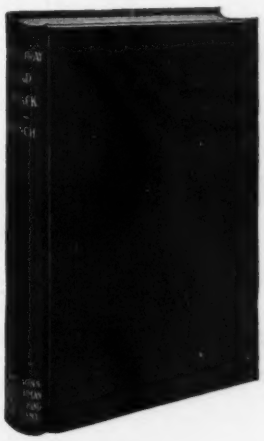

Revised and improved by the addition of new material, the second edition of "Roadway and Track" is even more helpful than the first. New sections now cover maintenance of switches and frogs, and practical methods of curve adjustment; new drawings and photographs illustrate devices recently introduced, methods lately adopted.

The New "Roadway and Track"

By W. F. Rench

covers in its contents

PART I—ROADWAY

I The Essential Elements in Roadway Maintenance
- A Summary of the More Important Points

II The Right of Way
- General Principles
- Legal Principles Affecting Right of Way
- The Effect of Encroachments
- Marking Right-of-Way Limits
- Benefits from the Re-Survey
- The Party Wall Law
- Lateral Support
- The Day in Court
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III Drainage of Roadbed and Track
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VI Economics of Roadway
- General Recommendations

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- The Adz and Rail Cutter
- Tie Tongs and Rail Tongs
- Hand Cars and Trucks and Pony Cars
- The Tool Grinder

PART II—TRACK

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- Cross-Tie Replacement
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IX A Program for M. W. & S. Work
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- Practice on a Main-Line Subdivision.

X The Track Obstruction
- Limitations in Maintenance Operations

XI Labor-Saving Devices and Methods in Track Work
- Statement of the More Common Items

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- Rails
- Ballast
- Track Fastenings and Accessories

XIII Practice in Rail Renewals
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- Putting in Service and Maintaining a New Line
- Raising and Shifting a Six-Track Main Line
- Improving a Subdivision After Neglected Maintenance

XVII Economics of Track Labor
- General Conclusions Based on Experience

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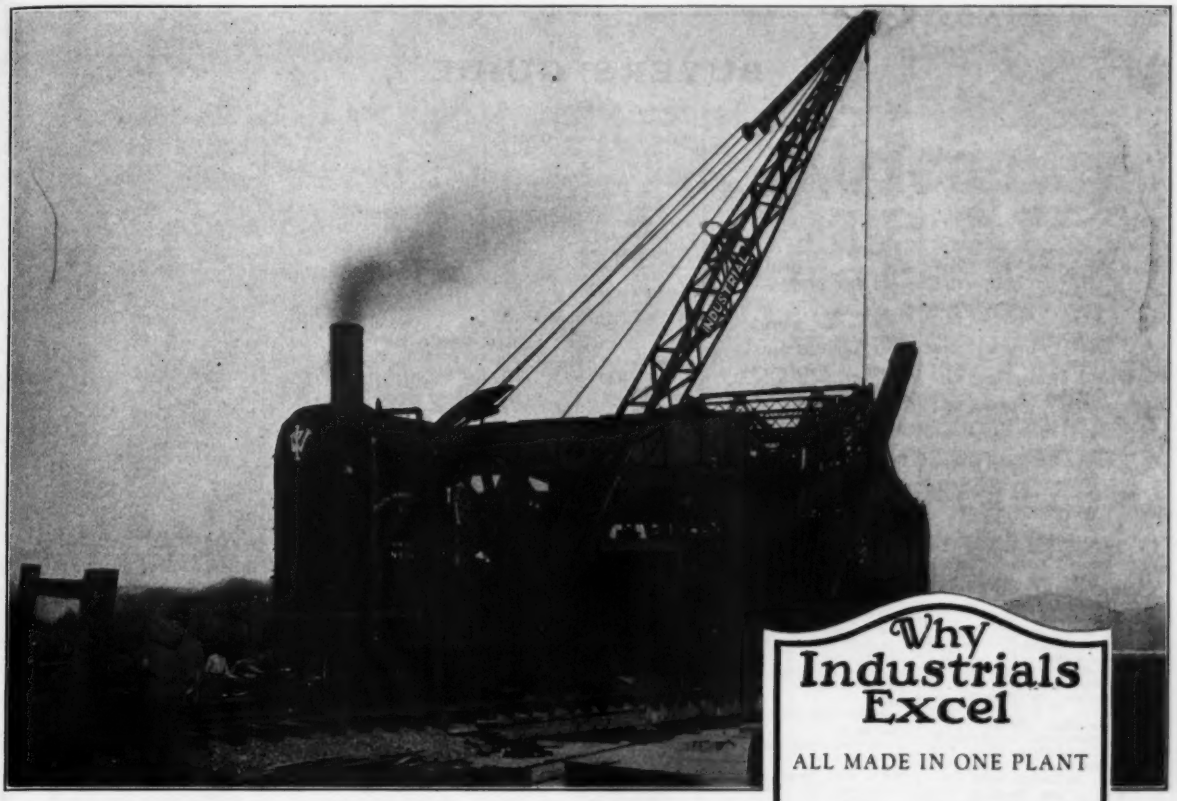

In building world-famous bridges

THE AMERICAN BRIDGE CO. speed their material-handling and insure mechanical precision in erection with their 35 INDUSTRIAL locomotive cranes. The selection of INDUSTRIALS by this internationally-known firm is an outstanding tribute to their superiority in construction and erection work.

INDUSTRIAL independent automatic hoisting drums give two hoisting lines. Reversing engines give positive control of heavy loads and Hindley-type worm boomhoist mechanism allows boom to be raised with maximum load suspended. These exclusive features also make INDUSTRIALS the fastest in bucket operation and dragline work.

Whether your needs be for a baby 5-ton or for a monster 200-ton, there is an INDUSTRIAL that will solve your material-handling problems. As an executive, it will pay you to investigate.

There are 17 standard types of INDUSTRIAL cranes with a capacity range from 5 to 200 tons. All are fully illustrated and described in our Golden Anniversary Catalog, a copy of which will be forwarded to you promptly upon request.

Why Industrials Excel

ALL MADE IN ONE PLANT

Raw materials are cast, forged, machined and assembled for all units of INDUSTRIAL cranes entirely in one plant, assuring perfect control of design, workmanship and delivery.

TESTED BEFORE SHIPMENT

Every INDUSTRIAL is completely built and fully tested under its own power before shipment. Full capacity loads are handled under actual and severe service conditions.

INDUSTRIAL WORKS

BAY CITY - MICHIGAN

Locomotive Cranes, 5 to 200 Tons—Transfer, Pillar & Gantry Cranes
Railway Pile Drivers—Combination Crane Pile Drivers—Transfer Tables
Portable Rail Saws—Grab Buckets—Magnets—Steam Pile Hammers

INDUSTRIAL LOCOMOTIVE CRANES

BUYERS' GUIDE

Pile Drivers.
Industrial Works.

Piling.
International Creosoting & Construction Co.
Massey Concrete Products Corp.

Pipe, Cast Iron.
McWane Cast Iron Pipe Co.

Pipe Carriers.
Massey Concrete Products Corp.

Pipe Concrete.
Massey Concrete Products Corp.

Pipe, Corrugated.
Armco Culvert & Flume Mfrs. Assn.

Plants, Welding and Cutting.
Air Reduction Sales Co.

Platforms, Station.
Headley Good Roads Co.

Plows, Railroad.
Western Wheeled Scraper Co.

Pneumatic Tools.
Ingersoll-Rand Co.

Poles.
International Creosoting & Construction Co.
Massey Concrete Prod. Corp.

Pony Car.
American Trackbarrow Co.

Posts, Fence.
Q. & C. Co.

Posts, Bumping.
Buda Co.
Mechanical Mfg. Co.

Powders.
DuPont de Nemours & Co., E I

Preservation, Timber.
International Creosoting & Construction Co.

Producers, Gas.
Air Reduction Sales Co.

Pumps, Air Pressure and Vacuum, Centrifugal, Deep Well, Piston, Plunger, Rotary, Sump.
American Well Works.
Goulds Mfg. Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Push Car Bearings.
Hyatt Roller Bearing Co.

Push Cars.
Buda Co.
Fairmont Railway Motors, Inc.
Mudge & Co.

Rail Anchors.
Lundie Engineering Corp.
P. & M. Co.

Rail Anti-Creepers.
Lundie Engineering Corp.
P. & M. Co.

Rail Benders.
Buda Co.
Q. & C. Co.

Rail Bond.
Verona Tool Works.

Rail Braces.
Buda Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Rail Joints.
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

Rail Saws, Portable.
Industrial Works.
Q. & C. Co.

Rail Springs.
Verona Tool Works.

Rare Gases.
Air Reduction Sales Co.

Regulators, Oxy-Acetylene.
Air Reduction Sales Co.

Removers, Paint
Mudge & Co.

Replacers, Car.
Buda Co.

Riveting Hammers.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works.

Rock Drills.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works.

Rods, Welding.
Air Reduction Sales Co.

Roller Bearings.
Hyatt Roller Bearing Co.

Roof Slabs.
Massey Concrete Products Corp.

Roofing Composition.
Lehon Co.

Rules.
Lufkin Rule Co.

Saw Mills.
American Saw Mill Machinery Co.

Saws, High Speed Friction.
American Saw Mill Machinery Co.

Saws, Portable Rail.
Industrial Works.
Q. & C. Co.

Saw Rigs.
American Saw Mill Machinery Co.

Scales.
Lufkin Rule Co.

Scrapers, Wheel, Drag and Buck.
Western Wheeled Scraper Co.

Screw Spike Drivers.
Ingersoll-Rand Co.

Sewer Pipe.
Massey Concrete Products Corp.

Sheet Fibre.
Diamond State Fibre Co.

Sheet Iron.
Armco Culvert & Flume Mfrs. Assn.

Shingles, Composition.
Lehon Co.

Signal Foundations, Concrete
Massey Concrete Products Corp.

Signals, Bridge Warning.
Hastings Signal & Equipment Co.

Skid Shoes.
Q. & C. Co.

Slabs, Concrete.
Massey Concrete Products Corp.

Smoke Stacks.
Chicago Bridge & Iron Works.
Massey Concrete Products Corp.

Snow Melting Devices.
Q. & C. Co.

Snow Plows.
Jordan Co., O. F.
Q. & C. Co.

Spreaders.
Jordan Co., O. F.
Western Wheeled Scraper Co.

Standpipes.
Chicago Bridge & Iron Works.

Standpipes (Penstock).
American Valve & Meter Co.

Stands, Switch and Target.
Q. & C. Co.
Ramapo Ajax Corp.

Station Houses.
Massey Concrete Products Corp.

Steel Forms.
Blaw-Knox Co.

Step Joints.
Q. & C. Co.
Rail Joint Co.

Storage Tanks.
Chicago Bridge & Iron Works.

Switches.
Buda Co.
Frog Switch & Mfg. Co.
Kilby Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Switch Locks.
American Valve & Meter Co.

Switchmans' Houses.
Massey Concrete Products Corp.

Switchstands and Fixtures.
American Valve & Meter Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Tampers, Tie.
Ingersoll-Rand Co.

Tanks, Water Storage.
Chicago Bridge & Iron Works

Tanks, Elevated Steel.
Chicago Bridge & Iron Works

Tanks, Oil Storage
Chicago Bridge & Iron Works

Tank Valves
American Valve & Meter Co

Tapes
Lufkin Rule Co

Telegraph Poles
International Creosoting & Construction Co.
Massey Concrete Products Corp.

Telltales.
Hastings Signal & Equipment Co.

Thawing Outfits.
Q. & C. Co.

Ties.
International Creosoting & Construction Co.

Tie Plates.
Lundie Engineering Corp.

Tie Plate Clamps.
Q. & C. Co.

Tie Rods.
Bethlehem Steel Co.

Tie Tampers.
Ingersoll-Rand Co.

Tie Tongs.
Maintenance Engineering Corp.

Timber, Creosoted.
International Creosoting & Construction Co.

Tools, Oxy-Acetylene Welding and Cutting.
Air Reduction Sales Co.

Tools, Wrecking.
Industrial Works.

Tongue Switches.
Buda Co.
Frog Switch & Mfg. Co.
Kilby Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Torches, Oxy-Acetylene Welding and Cutting.
Air Reduction Sales Co.

Track Barrow.
American Trackbarrow Co.

Track Drills.
Buda Co.
Ingersoll-Rand Co.

Track Insulation.
Diamond State Fibre Co.
Q. & C. Co.

Track Jacks.
Buda Co.
Duff Mfg. Co.
Idol Track Liner Co.
Verona Tool Works.

Track Liner.
Idol Track Liner Co

Track, Portable.
Western Wheeled Scraper Co.

Track Tools.
Buda Co.
Q. & C. Co.
Verona Tool Works.

Transfer Tables.
Industrial Works.

Treating Plants, Water.
American Water Softener Co.

Trestle Slabs.
Massey Concrete Products Corp.

Tunnel Warnings.
Hastings Signal & Equipment Co.

Vacuum Pumps.
American Well Works.
Goulds Mfg. Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Ventilators.
Q. & C. Co.

Warning Devices, Bridge and Tunnel.
Hastings Signal & Equipment Co.

Washers, Fibre.
Diamond State Fibre Co.

Water Column.
American Valve & Meter Co.

Water Crane.
American Valve & Meter Co.

Water Softening Plants.
American Water Softener Co.

Water Treating Plants.
American Water Softener Co.

Water Tanks.
Chicago Bridge & Iron Works.

Water Treating Tanks.
Chicago Bridge & Iron Works.

Waterproofing Fabrics.
Lehon Co.

Welding, Oxy-Acetylene.
Air Reduction Sales Co.

Wharf Cranes.
Industrial Works.

Wheels, Hand and Motor Car.
Buda Co.
Fairmont Railway Motors, Inc.
Mudge & Co.

Wire Fencing.
Cyclone Fence Co.

Wood Grapples.
Industrial Works.

Wood Preservation.
International Creosoting & Construction Co.
Q. & C. Co.

Woodworking Machnery.
American Saw Mill Machinery Co.

Wrecking Cranes.
Industrial Works.

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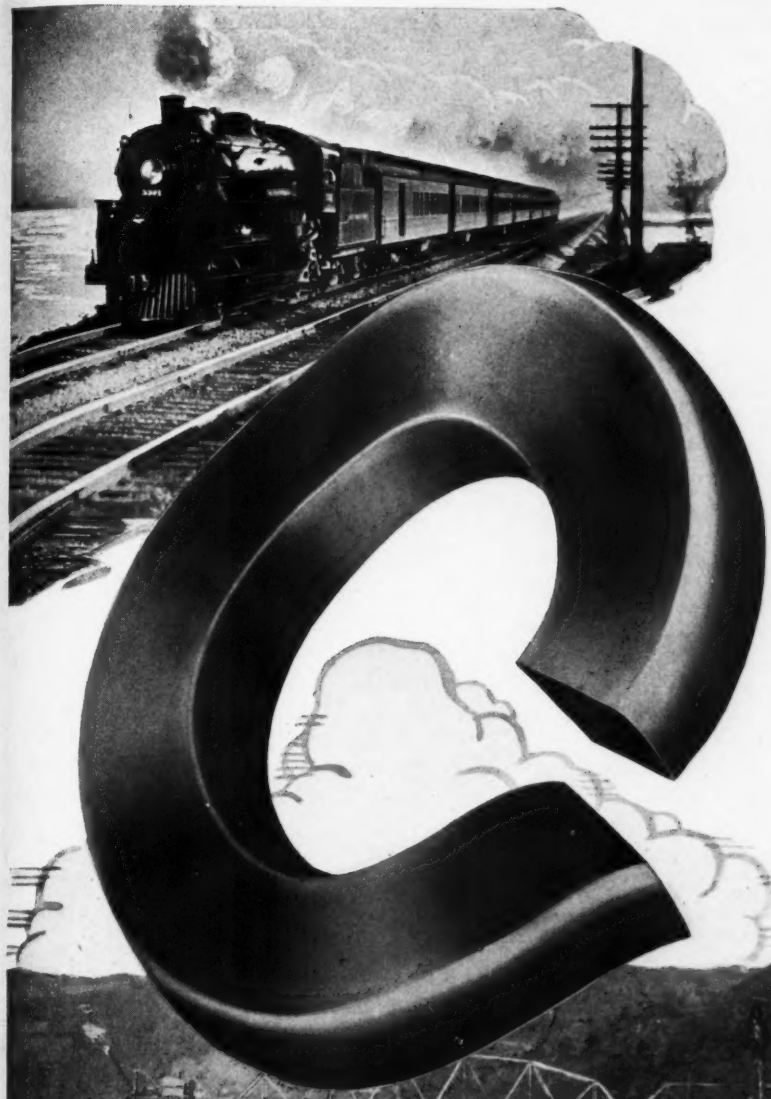
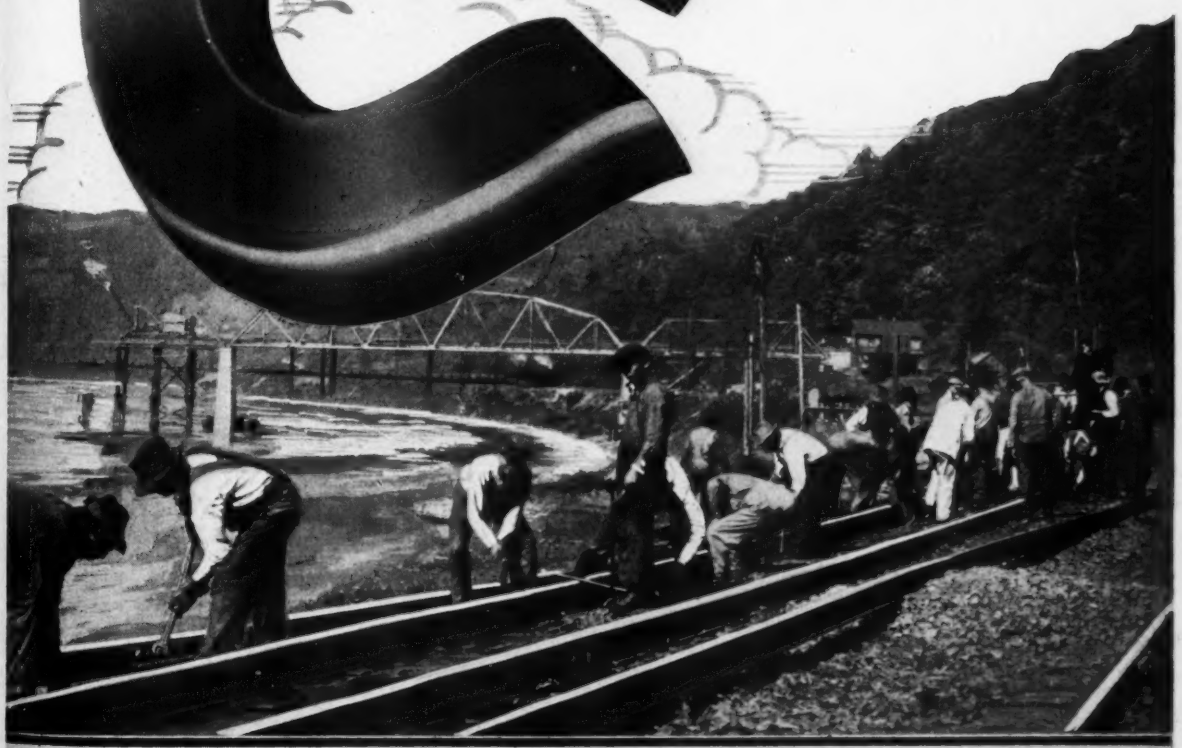


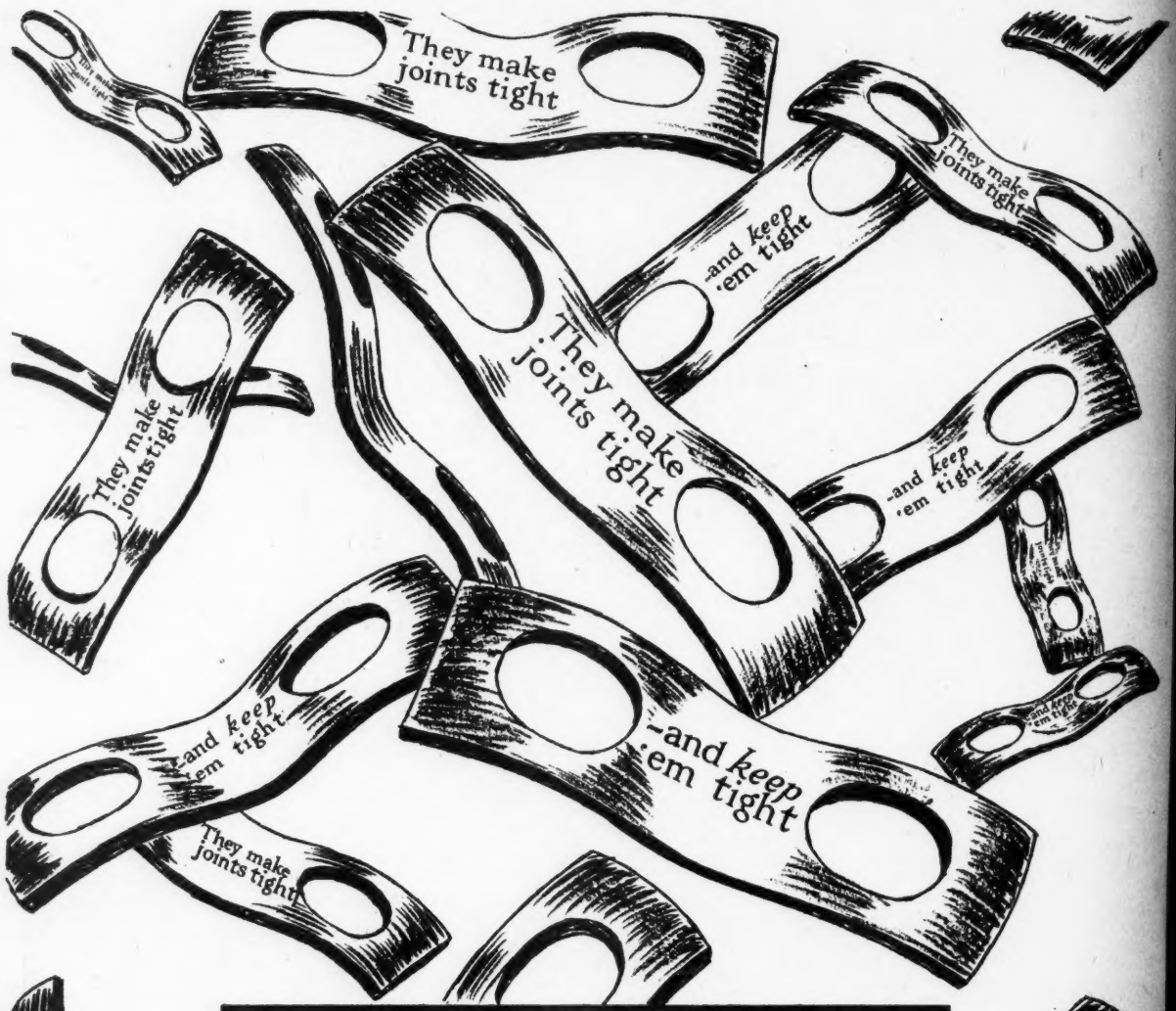
Efficiency

Improved HIPOWER is commercially non-flattenable—its ability to actively resist compression is limited only by amount of wrench pull. The high reactive pressure therefore ***Immediately*** and ***Adequately*** absorbs the shocks of heavy rolling loads and compensates for frictional wear as it occurs.

The National Lock Washer Co.
Newark, N. J., U. S. A.



IMPROVED
HIPOWER

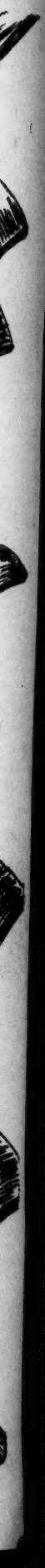


They make joints tight

That is easy. It is possible to make joints tight with a wrench alone—without any nut-locking device whatsoever. It is possible to store considerable reactive pressure in the elasticity of a heat-treated bolt. But Verona Rail Joint Springs make joints tight.

and *keep* 'em tight

That is ***not*** easy. To keep joints tight, a nut-locking device should compensate for the conditions that make joints loose—bolt stretch, rust, wear, and corrosion. Verona Rail Joint Springs deliver an average of 48,000 pounds thru a distance of 1-16 of an inch. After the initial application and two tightenings, it is never necessary to touch the bolts until new rail is laid.

VERONA TOOL WORKS

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